SCHOOL LEADERS’ ENGAGEMENT AND ITS ASSOCIATION WITH SCHOOLWIDE SUPPORTS AND PROGRAM FIDELITY: A SECONDARY DATA ANALYSIS OF POWERTEACHING MATH

by
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Abstract

This exploratory correlational study using archival program data explores school leaders' engagement levels and its association with program supports and fidelity of PowerTeaching Math, a cooperative learning-based whole school reform model. Because evidence-based interventions often have variable effects in the real world, investigating factors that support program implementation is an important step in making sure that any future iterations of PowerTeaching Math have the necessary supports so that its ecosystem can work together to ensure student achievement outcomes are met. Results of this secondary analysis indicate that an engaged leader has a statistically significant impact on the levels of schoolwide supports and program fidelity ($p = .017$ and $p = .018$). Furthermore, there is a large practical significance between program variables under discussion ($d = .61$, and $d = .61$ respectively). Findings from this secondary analysis are intended for program developers to gain a deeper understanding of school leaders' engagement and the role that it plays in the development of comprehensive schoolwide support systems and program fidelity.

Keywords: secondary analysis, mathematics, cooperative learning, systems, leadership, professional learning communities (PLC), professional development, coaching, program fidelity.

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Acknowledgments

The culmination of this dissertation closes a chapter of my life that began in 2007 when Dr. Nancy Madden hired me as an instructional designer to research and develop a multi-year teacher professional development series based on the work of Dr. Robert Slavin for the Success for All Foundation. From concept to reality, the development and validation of PowerTeaching Math have spanned over a decade, and I have had the unique opportunity to oversee and guide the scale-up of the program in hundreds of schools across the country, working with thousands of teachers, and impacting mathematics instruction for over 250,000 students.

Working to establish partnerships with states, districts, and schools to identify and prioritize their needs has helped me understand the necessity for an ongoing critical analysis of PowerTeaching Math. The PowerTeaching Math program has been adapted three times utilizing an action research approach to address and meet the needs of an ever-changing educational landscape. Through a team-based approach to problem-solving, establishing and developing solutions to various challenges related to resource management, project scope and timelines, technology, and professional development have been a result of ongoing collaboration with a group of dedicated professionals to whom I would like to say thank you. First and foremost, to Dr. Robert Slavin, Dr. Nancy Madden, and my colleagues at the Success for All Foundation, thank you for giving me the opportunity to join your mission of developing and disseminating research-based educational programs to ensure that all students, from all backgrounds, achieve at the highest academic levels (SFAF, 2018a). It has been an honor and a privilege to learn from and with you over the past 11 years, and I appreciate your willingness to help guide and support me on my doctoral journey. To Dr. John Nunnery and your colleagues at Old Dominion University, thank you for trusting and empowering me to manage your $25 million Investing in Innovation (i3) scale-up and randomized controlled study of PowerTeaching Math's impact on student achievement. John, our work has afforded us the opportunity to become friends, and I thank you for your continued mentorship and support. To Dr. Bethann McCain, Tracy Boone, and the numerous certified PowerTeaching coaches throughout the Commonwealth of Pennsylvania, thank you for your time, dedication, and contributions to PowerTeaching Math over the years. Your commitment to utilizing research-based practices in your respective areas has led to a grassroots movement throughout the Commonwealth of which I could not be more proud. To Dr. Jackie Nunn, and my colleagues at the Johns Hopkins University Center for Technology in Education, especially Veronique Gugliucciello, thank you for providing me the opportunity to leverage technology in pursuit of a PowerTeaching Math community of practice. Veronique, your dedication to education and our friendship means the world to me. Finally, I would like to say thank you to Dr. Stephen Pape and Dr. Christine Eith. As my initial program advisor and cohort lead respectively, your guidance, support, and willingness to find ways to address unforeseen roadblocks along this journey have enabled me to fulfill this ambition.

When I began my dissertation studies in 2015, I aspired to be among the best in education. After completing the first residency, however, I never imagined I would be a part of a cohort that shares in the same values and commitment to education as I do. The Johns Hopkins University School of Education 2015 Ed.D., cohort have inspired me to be the best I can be, and to that, I say thank you - especially to my doctoral partner Rena

Robey. Together, we have "swum" to the end of this journey, and I do not doubt that we will continue to help shape the educational world from what we have learned from each other.

My work and my world would not be complete if it were not for my family and friends who have loved and supported me throughout this adventure. I dedicate my degree to my children, Evan and Emily. I hope that my accomplishment inspires you to do great things in your own life and to use your abilities in ways that contribute to the world in which you live. As you go through life, remain selfless and humble, and always remember that this world is a better place because you are in it. To Kara, Jason, my parents (Ann and Mike), thank you for believing in me and helping me see my potential when I doubted myself. Collectively, you have spent countless hours being a guide on the side, proofreader, sounding board, confidant, and so much more. Although life has changed over the course of the years, I love you all, and this accomplishment is as much yours as it is mine. I end this acknowledgment with one of my favorite Walt Disney quotes, "We keep moving forward, opening new doors, and doing new things, because we're curious and curiosity leads us down new paths." As the doors close on my PowerTeaching Math and doctoral journeys, other doors are opening, and I cannot wait to see what is in store!

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Chapter 1 – Introduction

In 2016, MDRC, a non-profit research organization, completed a three-year randomized controlled trial and a scale-up study to determine the impact of PowerTeaching Math, a cooperative learning-based whole school reform model, on standardized math test scores at the school level (Grossman, 2018). The study was funded by a five year, $25 million Investing in Innovation (i3) scale-up award supported by the U.S. Department of Education. The purpose of this dissertation is to investigate the relationship between leadership, schoolwide structures, and program fidelity by conducting a secondary analysis of the data collected for the MDRC study using a correlational explanatory design (Creswell, 2012).

Problem Statement

Evidence-based interventions, like PowerTeaching Math, often have variable effects in the real world. Investigating factors that support implementation is an important step in making sure that any future iterations of the program in question have the necessary supports so that the system can work together to ensure student achievement outcomes are met. There have been 14 evaluations of the PowerTeaching Math strategy (formally known as Student-Teams Achievement-Divisions) in either elementary or secondary schools (Nunnery, Chappell, & Arnold, 2013). As Grossman (2018) summarizes, "the average impact on math test scores [of the PowerTeaching Math program] is a positive shift of 0.60 of a standard deviation for secondary school students and a 0.13 standard deviation shift for primary school students. The average impact of the studies that met the evidence standards of the What Works Clearinghouse was 0.42." (p. 1). The most recent study, however, showed little evidence of the program's impact on student achievement (see Appendix A for a copy of the MDRC evaluation results). Understanding the relationships between program variables that were not investigated in the MDRC study (i.e., leadership, schoolwide supports, and program fidelity) is important to see if any new findings can be identified that would allow program developers to make modifications to the program supports for new and existing schools.

Purpose and Significance of the Study

After the inconclusive results from the MDRC study regarding the program's impact on student achievement, this secondary analysis of archival data explored the reasons why research-based programs can have variable effects in the real world by investigating the relationships between school leadership, schoolwide supports, and program fidelity. This secondary analysis aimed to not only contextualize the research findings within the larger body of research but also identify new ways to market the program to new schools or to justify future funding needed to make program adaptations or enhancements based on the results.

Nature of the Study

A correlational explanatory design using archival data (see Creswell, 2003; Price, Rajiv, & Chiang, 2015) was used to determine if a relationship exists between two or more PowerTeaching Math program variables, and, if so, to what degree the relationship occurred. Using Johnston's (2013) three-step approach for conducting secondary analysis "that begins with the development of the research questions, then the identification of the dataset, and thorough evaluation of the dataset" (p. 620), quantitative data was used to describe, infer, and answer the identified research questions (Herbst & Coldwell, 2004).

Research Objectives

The objectives of this secondary analysis were to (1) explore the relationship between leadership and schoolwide supports, (2) explore the relationship between leadership and program fidelity, (3) understand how prepared leaders felt to support program implementation, and (4) identify the steps taken by school leaders to support the implementation of the PowerTeaching Math program.

Research Questions and Hypotheses

This study consisted of predictive and descriptive research questions (RQ):

RQ1. Is there an association between school leaders' engagement and comprehensive schoolwide support systems in schools implementing PowerTeaching Math?

$H_0$1: There is no association between school leaders' engagement and comprehensive schoolwide support systems in schools implementing PowerTeaching Math.

$H_1$1: Schools with a highly engaged school leader will have more robust levels of comprehensive schoolwide support systems than schools without highly engaged leaders.

RQ2. Is there an association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math?

$H_0$2: There is no association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math.

$H_1$2: Schools with a highly engaged school leader will have a higher level of program fidelity than schools without highly engaged leaders.

RQ3. How prepared did school leaders say they felt to support the implementation of PowerTeaching Math at the study schools?

RQ4. What steps did school leaders report taking at the study schools to implement PowerTeaching Math?

Conceptual Framework

To help identify program distinctions for this secondary analysis, a conceptual framework was created to help identify key program variables and to organize the ideas under investigation (see Figure 1.1). As Figure 1.1 illustrates, the PowerTeaching Math program is grounded in general systems theory in which leadership can have an impact on schoolwide supports and the instructional process when implementing a cooperative learning based intervention with fidelity. Taking a closer look at the association of leaders' levels of engagement to schoolwide supports and program fidelity through a systems approach allowed for an exploration of the program design to identify the contributing factors that may have led to inconclusive student achievement outcomes as determined by the MDRC study.

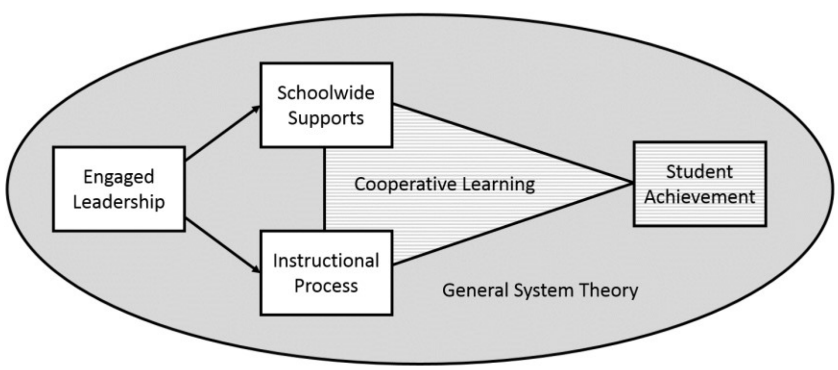

Figure 1.1 A conceptual framework of the key program elements under investigation.

General systems theory is most commonly understood as various interacting parts within an organization that form a whole. When these parts are aligned, a shared vision becomes the goal toward which energies are directed (Elmore, 2000; Spillane, 2005). As O'Connell, Hickson and Pillutla (2010) suggest, a strong vision developed by a strong leader can have a positive impact on the performance of an organization, often creating a "spark that lifts organizations beyond the mundane" (p. 104). Aligning all the parts of a system through a shared vision will substantially increase the fidelity and power of an intervention (Fullan, 2007).

Schools that effectively implement interventions tap into the synergy of a systems approach to ensure that the interrelationships are mutual, beneficial, and focused on optimal learning (Morrison, Ross, & Kemp, 2004; Zhao & Frank, 2003). Understanding that a system is not just parts of a school, but instead how all those parts, or microsystems, work together in either a nested or a networked approach is a key way of exploring program fidelity (Neal & Neal, 2013). Although teachers are a microsystem in a school, they alone do not create outcomes. Instead, it is the combination of leadership and schoolwide supports (i.e., coaching and Professional Learning Communities) that ultimately affect the quality of program success (Bryk and Gomez, 2015).

Without strong leadership, schools may struggle to implement a new program or intervention as they support their teachers through the change process. In many ways, being able to inspire and lead others is key to supporting the vision and mission of the school. As Setters and Field (1990) describe, "leadership not only rests on the shoulders of one individual but also all who share in the mission and vision" (p. 38). By establishing such an environment, a principal can influence others in pursuit of the mission and vision, creating a culture of highly motivated individuals (House & Aditya, 1997). As House and Aditya (1997) explain, “high achievement motivated individuals engage spontaneously in a high degree of self-regulatory behavior… without training and direction from others” (p. 413). Establishing systems and processes enable an effective leader not to be “personally involved in performing the work… and be reluctant to delegate authority and responsibility” (House & Aditya, 1997, p. 413) supporting the notion that problems reside in the system, not in the people.

Part of being an effective leader is not only the ability to lead and inspire others but to reflect on one's actions in the hopes of continuous improvement (Nesbit, 2012). As Onorato (2013) suggests, school leaders play many roles within a school. As principals define their roles within schools, leveraging both transformational, distributed, and authentic leadership approaches can help better establish a vision and mission that can provide strategic direction (Onorato, 2103; Tonkin, 2013). While an authentic leader is more open to the reality of the situation and will share those realities to build trust and transparency, a transformational leader may present only the information that supports the vision. An authentic leader is open to showing faults behind the scenes and is willing to engage others in decisions to help share the burden of achieving the vision and mission (Tonkin, 2013).

To help address problems and reinforce the notion that they reside within the system, professional development, professional learning communities (PLCs), and coaching can be used to provide teachers with networks of support. Teacher development is the key to program implementation and student success. The American Federation of Teachers recognizes that “continuous, high-quality professional development is essential to [the] nation’s goal of high standards of learning for every child” (American Federation of Teachers, 2002). Professional development is key for improving classroom instruction and is defined as a "systemic effort to bring about change in the classroom practices of teachers, in their attitudes and beliefs, and in the learning outcomes of students" (Guskey, 2002, p.381; Ball & Cohen, 1999; Darling-Hammond & McLaughlin, 1995; Elmore, 1997).

An instructional coach can be used to provide professional development and assist with the development of PLCs that can be used to support the goals of professional development. PLCs are driven by school leadership and originate from professional learning networks in which learning organizations achieve results through collaboration (Singe, 1990). Supported by various leadership models (e.g., transformational, instructional, or distributed), an instructional coach can support the development of reflective practitioners through (1) exploration, (2) critique, and (3) reflection. PLCs rely heavily on the establishment of a vision and mission that drives a need for continuous improvement (DuFour & Eaker, 2010). This notion reinforces a systems approach described earlier and allows for all members of the school to work toward a common goal, especially within turnaround schools where school attrition, low student performance, and a lack of teacher experience are contributing factors to the overall problem under discussion. PLCs promote collective responsibility for the development of each student (DuFour, 2004; King & Newmann, 2001) while developing reflective practitioners who seek and share knowledge through collaboration and problem-solving (DuFour, 2004; Hord, 2004).

Operational Definitions

Operational definitions of the program variables investigated are summarized below. Additional information regarding the units of measure used to operationalize each variable is provided in Chapter 3 (p. 77).

A Highly Engaged School Leader

A highly engaged school leader can best be described as the keeper of the vision. A key part in maintaining a school's vision is the ability to set high expectations for the performance of all students and adults in the building. The school leader's job is to make sure that the stage is set to support the PowerTeaching Math program in their building, monitor and celebrate progress, and keep motivation and energy high.

Comprehensive Schoolwide Support Systems

Comprehensive schoolwide support systems help to build ownership of processes, programs, and systems within a school. For the purpose of this study, comprehensive schoolwide support systems include, (1) access to program materials, (2) access to a full-time instructional coach, (3) regularly scheduled component team meetings or professional learning communities (PLCs), and (4) access to ongoing professional development opportunities.

Program Fidelity

Program fidelity is defined as "the extent to which delivery of an intervention adheres to the protocol or program model originally developed." (Mowbray, Holter, & Teague, 2003, p. 315). Program fidelity includes not only comprehensive schoolwide support systems but also adherence to program elements, as described in Chapter 3.

Assumptions, Delimitations, and Limitations of the Study

There were several assumptions made in this secondary analysis of archival study data. It was assumed that MDRC validated their study instruments and that the data from the three-year randomized controlled trial and a scale-up study uploaded to the Inter-university Consortium for Political and Social Research (ICPSR) by MDRC was cleaned and coded in accordance with ICPSR rules and regulations. It was also assumed that all schools involved in the original study were recruited in accordance with the program design that included a majority teacher vote for program adoption. In addition, it was assumed that the study and scale-up schools represented a mix of urban and rural schools across multiple states.

Data used in this analysis was limited to the program (n = 30) and scale-up schools (n = 38) that implemented the PowerTeaching Math program in the 2015-2016 school year. These 68 schools implemented the PowerTeaching program for at least two years, and some of their data was not included in the MDRC evaluation (specifically, teacher and principal school surveys) (Grossman, 2018).

It is evident that the data collected for the three-year randomized controlled trial and a scale-up study was clearly defined within the context of the original study. Because of this, the researcher had no control over possible bias in the original data. Data included in the ICPSR files, however, does not include all school achievement observation items developed and utilized to guide and support program implementation by the program developers, and principal survey data is only available for the schools that participated in the original randomized control trial and not the scale-up study.

Conclusion

This chapter provided an introduction and overview of the secondary analysis of archival data used to conduct a correlational study to determine if relationships between program variables exist and, if so, to what degree the relationships occur (Creswell, 2003; Price, Rajiv, & Chiang, 2015). Program variables identified for further investigation are (1) a highly engaged school leader, (2) comprehensive schoolwide support systems, and (3) program fidelity. The next chapter (Chapter 2) contains a literature review of PowerTeaching Math and the various program elements under discussion, exploring their relationships to school and program outcomes. The literature reviewed includes general systems theory, various leadership styles, coaching, and professional learning communities. In addition, the stages of change (Tuckman, 1965) and the concerns-based adoption model (Hall & Hord, 2001, 2011) are explored as a way of identifying how each program element interacts to help support a school through a program adoption process. Chapter 3 outlines the methodology used for the study and Chapter 4 presents the results of the analysis. Chapter 5 includes a summary of findings and discusses implications for practice, as well as recommendations for program developers and future research.

Chapter 2 – Literature Review

Following the results of a multi-year randomized controlled trial and a scale-up study of PowerTeaching Math, a whole-school approach to instruction that supports teacher's use of research-proven instructional practices in mathematics based on Student-Teams Achievement-Divisions (STAD) (see Slavin, 1987), a secondary analysis of program implementation data was conducted to better understand the relationship between a highly engaged school leader, comprehensive schoolwide support systems, and program fidelity. This chapter reviews the literature associated with the PowerTeaching Math program and the various program concepts under discussion (i.e., leadership, schoolwide supports, and program fidelity) by exploring their relationship to school and program outcomes. The literature review includes an overview of the program design, general systems theory, various leadership styles to support change, situated learning, professional learning communities, and coaching. In addition, Tuckman's (1965) stages of change and the concerns-based adoption model (Hall & Hord, 2001, 2011) are explored in order to determine how the various program elements interact to help support a school through a program adoption process.

Mathematics Achievement in the USA

Students in the USA continuously perform poorly in mathematics in comparison to their peers in similar nations. On the 2012 Program for International Student Assessment tests (Organization for Economic Co-operation and Development, 2013) for example, fifteen-year-olds from the United States scored 36th among participating countries, falling behind several Asian countries, and others such as the Netherlands, Canada, Poland, Germany, Australia, Ireland, France, the U.K., and Russia. According to the 2013 fourth-grade National Assessment of Educational Progress (National Center for Education Statistics, 2015), 54% of Caucasian students scored proficient or above, but only 18% of African American, 26% of Hispanic students, and 24% of all students qualifying for free lunch scored equally as high. Only 9% of Caucasian students scored below the minimum basic level, but 34% of African-American, 27% of Hispanic, and 28% of all free-lunch eligible fourth graders scored similarly. Scores for all groups have shown significant improvement since 1990, but substantial gaps remain.

To address these educational gaps, there has been an increasing emphasis on accountability and growth across the education sector. To meet accountability standards, states, districts, and schools are increasingly adopting evidence-based practices as a way to adapt instruction to better meet and advance the competencies of all students and ensure that all children have equal opportunities to learn (see Gee, 2008). As Metha (2013) suggests, “while in the past the primary cleavages that defined education politics were between left and right, [in recent years] a bipartisan accountability movement has joined legislators of both parties to call for reforms of underperforming teachers and schools” (p.883-884). This joint focus toward a standards-based approach and varying accountability measures has enabled extensively researched programs to be scaled-up across the country in the hopes of addressing the educational shortcomings that exist throughout the country.

The Rise of Evidence-Based Programs

Today there is a bipartisan effort to incorporate language that supports the development and use of research-proven practices in educational policy. Over the past 20 years, policies such as Comprehensive School Reform (CSR), Race to the Top (R2T), Investing in Innovation (i3), and School Improvement Grants (SIG) have created competitive grant opportunities for states, districts, schools, and educational organizations to address educational needs in priority areas (e.g., innovations that support effective teachers and principals, improve the use of data, turn around persistently low-performing schools, and increase STEM opportunities for all students) through the development, validation, and scale-up of programs and interventions that have a demonstrated impact on student achievement. As the USDOE (2017) states in its request for i3 proposals,

> The purpose of this program is to provide competitive grants to applicants with a record of improving student achievement and attainment in order to expand the implementation of, and investment in, innovative practices that are demonstrated to have an impact on improving student achievement or student growth, closing achievement gaps, decreasing dropout rates, increasing high school graduation rates, or increasing college enrollment and completion rates. These grants will (1) allow eligible entities to expand and develop innovative practices that can serve as models of best practices, (2) allow eligible entities to work in partnership with the private sector and the philanthropic community, and (3) identify and document best practices that can be shared and taken to scale based on demonstrated success. (para. 3).

Since the inception of the i3 fund in 2010, there have been 172 grants awarded. Old Dominion University (ODU) was awarded a $25 million i3 grant to evaluate and disseminate PowerTeaching Math. ODU contracted with MDRC to carry out a multi-year randomized controlled trial and scale-up study in partnership with Johns Hopkins University, Success for All Foundation, and various LEAs throughout the country.

Despite the push for continued research on evidence-based programs and federal recommendations that promote the use of such programs (see the Reading Excellence Act, 1998; No Child Left Behind Act [NCLB], 2001; and Every Student Succeeds Act [ESSA], 2015), there has been little impact on practice and student outcomes (Slavin, 2016). Because of new or revised educational policies around the use of evidence-based practices, educators are often expected to implement research-based programs to raise student achievement. Without appropriate training and support, however, a lack of leadership supports, schoolwide systems of supports, and program fidelity often leads teachers to believe that a program is ineffective before it has had a chance to be successful.

PowerTeaching Math Program Overview

PowerTeaching Math is a comprehensive schoolwide curriculum that links college and career readiness standards and curriculum to research-based instructional strategies and classroom resources that have been shown to promote rigor and student engagement. As defined by program developers, "successful math achievement is the result of a thoughtful, well-researched program, executed and consistently maintained by researchers, coaches, mentors, principals, teachers, and parents – each committed to student success. In that sense, when a child succeeds, it is because of a successful ecosystem." (SFAF, 2018b). The PowerTeaching Math program is a part of the Success for All Foundation's (SFAF) ecosystem that includes a coordinated effort to help implement an interactive curriculum for math in grades 6-8 and Algebra I through various schoolwide supports that incorporate and blend face-to-face and online professional development opportunities, coaching, and professional learning communities. A conceptual model of the SFAF ecosystem is shown in Figure 2.1.

Figure 2.1. A conceptual model of the Success for All Foundation's ecosystem. Reprinted from "*Our Approach: Schoolwide Programs*," by Success for All Foundation, 2018b. Copyright (2018) by Success for All Foundation, Inc. Reprinted with permission.

SFAF's Ecosystem

For over 30 years, the Success for All Foundation has worked directly with educators in thousands of schools throughout the United States, Canada, and the United Kingdom in disadvantaged communities to help their students achieve math levels at or above the norm. In hundreds of these institutions, SFAF students attained the highest math levels statewide (SFAF, 2018c). To help support and align their effort, SFAF built itself upon an ecosystem that combats poverty and disadvantage through continuous research and cooperative learning based strategies. Initially developed by Johns Hopkins University researchers, SFAF leverages professional development for educators and establishes schoolwide and leadership structures supported by a collaborative whole-school framework. The result of the SFAF ecosystem is a systemic approach to increasing student achievement through curriculum, cooperative learning, assessment, learning climate, and improved coordination of resources. An overview of each element of the SFAF ecosystem is detailed below.

Research

Dr. Robert Slavin and his colleagues at Johns Hopkins University Center for Research and Reform in Education (formerly the Center for Social Organization of Schools) and SFAF have dedicated the past twenty-five years to the research and development of cooperative-learning methods. Cooperative learning refers to a set of instructional practices in which students work in small, mixed-ability learning teams to achieve a common goal. The students in each team are responsible not only for their own learning but also for helping their teammates learn (Slavin, 1995). Slavin (1989, 1992, 1995) has identified four major theoretical perspectives on the achievement effects of cooperative learning: motivational, social cohesion, cognitive-developmental, and cognitive-elaboration. Furthermore, Slavin posits that all four of these theories have some bearing on why cooperative learning is effective.

Motivational theoretical perspective. The motivational theory hypothesizes that if students value the success of their teammates, they will work together to help one another achieve their learning goals. Slavin's (1995) research concluded that individual accountability, equal opportunities for success, and team recognition be present to ensure that each team member values the notion of teamwork, the learning goal, and ultimately, the team's success in reaching the learning goal.

Social cohesion theoretical perspective. The social cohesion perspective (also called social interdependence theory) suggests that the outcomes associated with cooperative learning are primarily dependent on the cohesiveness of the group (Slavin, 1995). In theory, students help one another learn because they care about their team and teammates and come to derive self-identity benefits from group membership (Hogg & Turner, 1987; Johnson & Johnson, 1989, 1999). A vital element of the social-cohesion perspective is an emphasis on team-building activities that are conducted prior to cooperative learning-based processing activities or group self-evaluation during and after group activities. However, team building alone does not always produce higher achievement for all students. Interaction among teams must be modeled, taught, and highly structured for this perspective to be valid (Slavin, 1995).

Cognitive-developmental theoretical perspective. One extensively researched set of cognitive theories is the developmental perspective (Damon, 1984; Murray, 1982). The assumption of the developmental perspective on cooperative learning is that interaction among students around appropriate tasks increases their mastery of critical concepts. Vygotsky (1978) defined the zone of proximal development as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers." (p. 86). Collaborative activities among students promote growth because students are likely to be operating within one another's proximal zones of development, modeling the collaborative group behaviors that are more advanced than those that they could perform as individuals (Slavin, 1995).

Cognitive-elaboration theoretical perspective. Research in cognitive psychology suggests that if information is to be retained in memory and related to information already learned, the learner must engage in some cognitive restructuring, or elaboration, of the material (Wittrock, 1986). As Kramarski & Mevarech (2003) suggest, "one of the most effective means of elaboration is explaining the content to someone else" (p. 282). Students who gain the most from cooperative activities are those who provide explanations to their peers (Webb, 1989, 1992), and those students who received explanations have been shown to learn more than those students who worked alone (O'Donnel & Dansereau, 1992).

With a commitment to continuous improvement, Johns Hopkins University Center for Research and Reform in Education and SFAF routinely make updates to their programs based on research and conduct independent evaluations to ensure that any changes made are still validated by research. According to a review undertaken by Nunnery, Chappell, and Arnold (2013), there have been 14 randomized experiments or quasi-experiments to evaluate the impacts of the PowerTeaching Math program strategy (formally known as Student-Teams Achievement-Divisions or STAD) in either primary or secondary schools. As Grossman (2018) summarizes, "the average impact on math test scores [of the PowerTeaching Math program] was a positive shift of 0.60 of a standard deviation for secondary school students and a 0.13 standard deviation shift for primary school students. The average impact of the studies that met the evidence standards of the What Works Clearinghouse was 0.42." (p. 1).

Cooperative Learning

The PowerTeaching Math program is a form of cooperative learning, one of the most researched and recognized approaches to mathematical pedagogy in schools (Nunnery, Chappell, & Arnold, 2013). Reviews of mathematics interventions by Slavin, Lake, and Groff (2009), and Slavin and Lake (2008) found that Student-Teams Achievement-Divisions in Math had stronger effects on mathematics achievement than other interventions and curricular programs. The effects of PowerTeaching Math are both positive and statistically significant across all grade levels, with substantially stronger effects in secondary schools than elementary schools (Cohen's *d*= +0.34 and +0.11 respectively) (Nunnery, Chappell, & Arnold, 2013)

PowerTeaching Math has been demonstrated to increase academic success by establishing a student-centered classroom using compelling concept presentations, assessments for learning, and cooperative learning teams. Research on PowerTeaching (STAD) has found strong impacts on student learning in mathematics if classrooms are structured to incorporate group goals and individual accountability (Davidson & Kroll, 1991; Slavin, 1995; Slavin, Hurley, & Chamberlain, 2003; Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003; O'Donnell, 2000; Slavin & Karweit, 1984; Johnson & Johnson, 1999). As the Investing in Innovation proposal states,

> The positive interdependence structured by the STAD-Math model facilitates increased use of the higher-level thinking strategies that are required for achievement in advanced mathematics courses (Gabbert, Johnson & Johnson,

1986; Johnson & Johnson, 2009; Johnson & Johnson, 1981b.; Johnson, Skon & Johnson, 1980; Skon, Johnson & Johnson, 1981). Shared social contexts provide support for students to construct mental models, solve problems, extend mathematics conceptual understandings, and build higher-order thinking skills (Bostic & Jacobbe, 2010; Donald, 1991; Egan, 2010; Johnson & Johnson, 2009; Lave & Wenger, 1991; Mueller & Maher, 2009; Nebesniak & Heaton, 2010; Nelson, 1996; Zakaria, Chin & Daud, 2010). The content specific discussion and collaboration embedded in the STAD-math model promotes higher-level mathematical thinking (Nunnery, Slavin, & Madden, 2010; Zakaria, Chin & Daud, 2010).

The PowerTeaching Math program includes comprehensive lesson resources that are enriched with multimedia examples, and videos that keep the focus on fun and on learning mathematics. All academic program pieces have both a formative and a summative classroom-assessment system built into a cycle of effective instruction. Teammates use a variety of rubrics to help analyze their written and verbal responses, and they hold one another accountable for quality answers (SFAF, 2018d). The National Council of Teachers of Mathematics (NCTM) suggests that an interactive pedagogy approach is essential for math learning and application (NCTM, 2008). A logic model of the PowerTeaching Math program is shown in Figure 2.2.

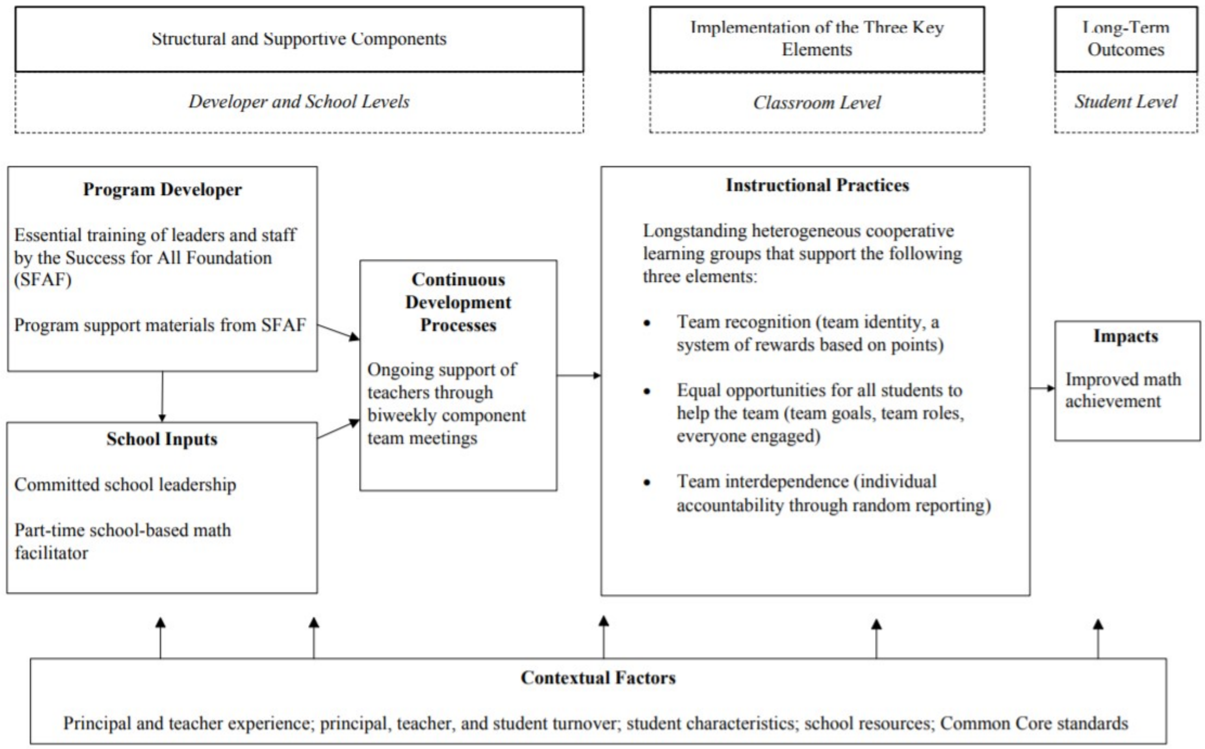

Figure 2.2. PowerTeaching Math program logic model. Reprinted from "*Group Work Is Not Cooperative Learning: An Evaluation of PowerTeaching in Middle Schools: A Report from the Investing in Innovation (i3) Evaluation*" by Rappaport et al., 2017. Copyright (2017) by MDRC.

Professional Development

Although math content knowledge is an important aspect of teacher effectiveness, it does not ensure that effective instruction takes place in the classroom (Shechtman, Roschelle, Haertel & Knudsen, 2010). Because of this, the SFAF approach is supported by extensive data-informed professional development and job-embedded coaching that enables teachers and school leaders to make the most of SFAF's research-proven instructional approach. SFAF's professional development integrates pedagogical understanding and knowledge of content to increase the implementation of a standards-based teaching approach aligned with state and national mathematics standards (Ross, Hogaboam-Gray & Bruce, 2006). Supported by a network of SFAF coaches, this professional-development model guides and supports schools as they establish and work towards student achievement targets.

GREATER Coaching.

SFAF's GREATER coaching design provides ongoing support tailored to teachers' needs and onsite instructional coach training and guidance in establishing common planning and collaboration time to provide peer-to-peer support (SFAF, 2013a). GREATER coaching enables SFAF coaches to collaborate with school leaders, instructional coaches, and teachers to establish a defined focus for increasing student achievement. Using school data to drive the GREATER coaching process, teachers participate in coaching that is tailored to their specific needs and concerns. The GREATER coaching process includes the following elements: (1) the identification of a performance goal that the teacher wants his or her students to achieve, (2) an assessment of the current reality in the classroom that the teacher has identified as a barrier to accomplish the goal, (3) brainstorming and exploring strategies that can be utilized or strengthened to ensure that the teacher achieves their goal, (4) the selection of a meaningful strategy to help support teachers' efforts , (5) the identification of actions of the instructional coach/school leader/teachers and/or the SFAF coach to help support the implementation of the adopted strategy, (6) the identification of who, what, when, and where of the action plan to create a focus and sense of urgency, (7) the utilization of data to evaluate the short-term goal set and celebrate success, and (8) re-evaluating current goals or setting new short-term goals to continue working towards meeting annual schoolwide goals (SFAF, 2013a).

Schoolwide Supports

SFAF believes that the successful implementation of classroom instructional programs is a schoolwide effort and depends on teacher collaboration through professional component team meetings (based on the notion of Professional Learning Communities - PLCs). All SFAF program materials, resources, and coaching supports are designed to guide a school's implementation and ongoing learning through component teams.

Component teams. Successful schools and teachers do more than have meetings or solve immediate problems together; they organize themselves and their resources to make a lasting impact through component teams. When teachers become more familiar with the instructional processes of classroom programs, their focus shifts from logistics and lesson structure to student progress. High-performing component teams serve students and teachers successfully by demonstrating these attributes:

- relentless, systemic focus on student achievement;
- ongoing, collaborative analysis and evaluation of data at the classroom and school level;
- group commitment to goal setting and monitoring results;
- professional support through peer observations and feedback, reporting concerns, and sharing results; and
- dependable routines for establishing rotating roles and responsibilities that address component team topics, meeting schedules, agendas, record keeping, and meaningful participation from all component team members.

Once component teams become more goal and data-driven, student outcomes and data dictate the topics for further teacher discussion and study. Ongoing learning and continuous improvement are the goals of teachers who are determined to improve their practice by setting high expectations and holding one another accountable.

Leadership Supports

SFAF's *Leading for Success* is a collaborative leadership system that brings school staff together to focus everyone's efforts on success for every student. Teachers, school leaders, and support staff work together to assess status, set annual and quarterly growth goals, identify measurable targets for short-term improvement, make a detailed action plan to ensure achievement of those targets, review quarterly progress, celebrate targets met, and plan the next steps for continuous improvement. *Leading for Success* is the part of SFAF's whole school program (including the PowerTeaching Math program) that aligns all the resources and systems in the school to address schoolwide goals, facilitate effective implementation of instruction, and ultimately improve student achievement. This distributed leadership model is organized and overseen by the leadership team, and the work is fulfilled by the *Leading for Success* teams that represent the school's systems and instruction (SFAF, 2013b).

School leadership team. To support a schoolwide coordinated effort, the Leadership Team meets at least monthly to review and analyze school data. The leadership team is responsible for managing the change that is taking place in the school. Gaining an awareness of the SFAF program being implemented, the change process, and the demands being placed on staff members, the Leadership Team accepts the responsibility of coordinating efforts, building systems and ensuring that all staff is supported through the process of change and implementation. Ultimately, this group helps to ensure that the goals and targets for the school are clear and all resources are focused and aligned in achieving them. Members of the leadership team also share the responsibility of making certain that the component teams, which represent the major systems of the school, have all the necessary resources and supports needed.

Members of the leadership team. The leadership team is generally representative of the school community. These people have the schoolwide perspective as a part of their role and position. The size of the team and membership varies depending on the resources and personnel available.

Whole School Reform

The SFAF ecosystem is designed to support a whole school reform effort to improve the learning opportunities for all students (SFAF. 2018b). The SFAF ecosystem represents a coordinated effort that includes research-based methods and strategies (e.g., cooperative learning and coaching) to focus processes and practices for the improvement of learning conditions (McPartland, Balfanz, Jordan, & Legters, 2005). Adopting and implementing a whole school reform model, however, can be challenging. Roadblocks, including staff commitment, politics (both internal and external), and finances often derail efforts (Murphy et al., 2001; Pechman & Fiester, 1994).

PowerTeaching Math requires not only a change to existing math practices and curricula at the district/schools but also a whole school commitment to continuous improvement. Obtaining the necessary buy-in supports innovation diffusion (see Rogers, 2003), which describes "the process through which a public policy or program spreads among the members of a school or district" (McLendon, Cohen-Vogel, & Wachen, 2015,

p. 99). The success of PowerTeaching Math is dependent on the understanding of all stakeholders and their socio-organizational context (Warford, 2010). As Warford (2010) describes, "the innovation, the [stakeholders] and their socio-organizational contexts, as well as the flow of information about the innovation through various communication structures and channels" (p. 3) needs to be addressed to ensure buy-in occurs across the system and that the schools/district understands the commitment that is being made to support program adoption. This level of transparency at the buy-in level helps with program advocacy as roadblocks arise during program adoption and implementation.

The notion of an advocacy coalition framework can be used to explain the support needed to implement a whole school reform model. The advocacy coalition framework "is associated with the idea that [stakeholders] engage in the policy process to turn their beliefs into public policies, by forming coalitions with like-minded people and competing with coalitions of people with different beliefs." (Cairney, 2015). Beliefs of stakeholders can be broken into three categories: (1) core beliefs, (2) program beliefs, and (3) secondary beliefs concerning program implementation. Stakeholder core beliefs are beliefs that are fundamental and unlikely to change. These beliefs, as well as the program beliefs of stakeholders, may be at odds with the theoretical base of PowerTeaching Math or elements of the program design (e.g., constructivism and cooperative learning). Secondary beliefs are those beliefs of stakeholders that are likely to change once various program elements prove to be successful (e.g., actionable feedback, rewards, and motivation).

Barriers to implementing PowerTeaching Math.

Schools that adopt PowerTeaching face many barriers to implementation, as key stakeholders are often unaware of the fundamental shift that is needed to implement a whole school reform model. Literature suggests that there is often a disconnect between a program being implemented and teachers' views and beliefs about education (Briscoe, 1991). As defined by Kagan (1992), teacher beliefs are the "unconsciously held assumptions about students, classrooms, and the academic materials being taught" (p. 65). These beliefs can be extremely influential, more so than teacher knowledge, and they determine how teachers make instructional decisions on a daily basis (Kagan, 1992).

Self-efficacy is a critical factor in determining teacher behavior. Self-efficacy "reflect[s] the confidence learners report in approaching and handling new tasks" (Hill, Song, & West, 2009, p. 96). Furthermore, "self-efficacy influences the likelihood of engaging with a task or instruction, the confidence reported in learning, and the probability that knowledge or skill will be applied." (Hill, Song, & West, 2009, p. 96). This idea is especially true for teachers and the change process associated with their implementation of a program or intervention. Teacher's actions are often driven by their past experiences, in fact, "past and present factors continually influence the teacher… The level of efficacy thus influences whether teachers will try, how hard they will persist, and in part, how well they will succeed at the innovation." (Ohlhausen, Meyerson, & Sexton, 1992, p. 538).

Despite the developers attempt to obtain program buy-in for PowerTeaching Math at the adoption level; core, program, and secondary beliefs are often formed before a full understanding of the program is in place. To implement a cooperative learning model, teachers are not only required to know how it functions in the classroom but need to have an understanding of the shift in pedagogy that needs to take place (Hennessey & Dionigi, 2013). In a qualitative study of 12 Australian teachers conducted by Hennessey and Dionigi (2013), varying knowledge of cooperative learning informed the perceived factors that teachers felt would affect the implementation of cooperative learning (Hennessey & Dionigi, 2013). Factors identified through semi-structured interviews included (1) a lack of understanding, (2) student age, (3) the behavior of students, and (4) teacher planning and control. As Hennessy and Dionigi (2013) highlight, their findings are constant with other research that highlight the "difficulties of translating educational theory into practice in mass in schools." (p. 68).

With the different factors associated with cooperative learning implementation and fidelity, it is estimated that the sustained used of cooperative learning ranges between 10% to 93% with a school (Antil, Jenkins, Wayne, & Vadasy, 1998). To support PowerTeaching Math's whole school reform efforts, a systems approach to support change provides the foundation of the SFAF ecosystem and program. Ongoing training and job-embedded supports are designed to address teacher beliefs and self-efficacy (Joyce & Showers, 1988; Mathison, 1992), and leadership supports are embedded to help maintain principal engagement whilst developing a school climate and collaborative culture necessary to promote change (Fullan & Hargreaves, 1997).

A Systems Approach to Change

As illustrated in Chapter 1, exploring the relationship between leadership, schoolwide supports, and program fidelity within a school is key to understanding the impact of a program or intervention. Bronfenbrenner's (1979) Nested Model of

Ecological Systems helps to identify factors throughout the school that work together toward a common goal. By critically analyzing each layer of the system at large, the primary factors preventing successful whole school reform and program outcomes were identified, and relationships were explored to identify the breakdown that is contributing to the problem under discussion.

General Systems Theory

Relationships between the interactive parts of a school can be defined in a variety of ways. Understanding how the interactions produce desired results is explained by the various parts interacting to form a whole or general systems theory (Elmore, 2000; Spillane, 2005). When these parts are aligned, a shared vision becomes the goal to which energies are directed (Elmore, 2000; Spillane, 2005). Aligning all the parts of a system through a shared vision will substantially increase the power of an intervention (Fullan, 2007). Because every system is composed of microsystems, the effectiveness of any intervention increases when all those systems are aligned, establishing an environment driven by a vision that allows the system to address both positive and negative intentions and consequences. As Staples, Pugach, & Himes (2005) conclude from multiple case studies of urban elementary schools implementing a technology initiative, a clearly defined vision serves as a guide for teachers and administrators as they weather the stages of change. These qualitative studies followed three urban elementary schools with similar technology resources as they integrated a technology initiative as a part of *Preparing Tomorrow's Teachers to Use Technology*, a federally funded Title II grant. Data sources for analysis included observation field notes, journals, semi-structured interviews with school personnel, and a timeline of technology-related priorities and supporting events (i.e., teacher professional development). In addition to vision alignment, teacher leadership and recognition for technology use were identified as scaffolds for effective program fidelity. In a study of six schools in Australia, Hayes (2007) found that teachers integrated technology with more fidelity when a strong curricular vision was established, and teaching practices supported the use of Information and Communication Technologies (ICT). Hayes' (2007) findings are based on a qualitative study that analyzed data from observations and interviews with various stakeholders (e.g., teachers, administration, and technology coordinators). The goal of the qualitative study was to identify and document the various ways schools integrate ICT as a way of supporting program fidelity and the teaching and learning process. Triangulation of data determined that ICT was used to support or supplement existing classroom practices. For ICT to be used to maximize its potential, fundamental shifts in existing practices need to be made. Furthermore, utilizing transformational, authentic, and distributed leadership models promotes alignment within the organizational system so that all stakeholders know their role in making the vision a reality for the school (Balyer, 2012).

Schools that effectively implement interventions tap into the synergy of this systems approach to ensure that the interrelationships are mutual, beneficial, and focused on optimal learning (Morrison, Ross, & Kemp, 2004; Zhao & Frank, 2003). Understanding that a system is not just *parts* of a school, but instead how all those *parts* work together in either a nested or a networked approach is a key way of exploring program fidelity (Neal & Neal, 2013). As Bryk and Gomez (2015) describe, it is the combination of resources, teachers, school leadership, and other tools that can affect the quality of program fidelity and student learning. Program fidelity increased among teachers when the time and resources were provided to support a collaborative apprenticeship model (Glazer, Hannafin, and Song, 2005).

Frink (1991) described microsystems as the relationships held between teachers, content, contexts, and their environment. The clarity, organization, and communication among microsystems affect the functioning of the system as a whole. Alignment of the microsystems is essential to the overall success of the entire system (Ackoff & Emery, 2006). Teachers, for example, are a microsystem in a school, but teachers alone do not create student learning. When changes are made in this microsystem, relationships can be affected (Frink & Thompson, 2004). The combination of program resources, teacher support (through PLCs and coaching), and school leadership affects the quality of program fidelity and ultimately student learning outcomes. The quality of staff and curriculum may be less important than the quality of system organization. Hard work goes into identifying and aligning all of the microsystems that are a part of the continual support provided throughout the system. There are many reasons why schools function well or poorly, for example:

- Experience and expertise of staff.
- Clarity of school hierarchy.
- Alignment of personnel and expectations.
- Clarity of job roles and responsibilities.
- Clear and concise communication system not in place (Fullan, 2007).

Supporting teacher learning and development means that each microsystem of a school (e.g., school leadership, teachers, students, and community) should be aligned to the school's mission and vision so that positive change can occur. To promote alignment and support teachers throughout the stages of change (Tuckman, 1965), instructional coaches whose purpose it is to work with school leadership to ensure that adequate time and resources are allocated to meet the overall goals is essential (Snodgrass Rangel, Bell, & Monroy, 2017). As Fullan (2002) suggests, effective school leadership is based on creating a collaborative environment. His Framework for Leadership suggests that moral purpose, understanding change, relationship building, knowledge, and coherence are all key components in the creation of an environment that instills enthusiasm, hope, and energy. In creating such an environment, there is a greater likelihood that leadership will see an increased overall commitment from staff and positive changes at the student level (Fullan, 2002).

Navigating Change through Systems

A key aspect of any new initiative is navigating through the initial barriers to change (Ertmer, 1999). As with any change process, some roadblocks can be anticipated, and others will identify themselves over the course of the intervention. Some of the anticipated barriers to the proposed intervention may include teacher attitudes, beliefs and willingness to engage in the intervention (Ertmer, 1999), as well as a potential dip in student achievement as focuses are shifted (DuFour,2007; Fullan, 2007). When unanticipated problems arise, general systems theory suggests they tend to reside in the system and not the people, so efforts to improve the system through collaboration and problem solving may be effective: (1) an awareness of problems and potential obstacles, (2) an understanding of why the problems exist, (3) action planning to maximize impact, (4) competence in effective leadership, and (5) commitment to continuous improvement (Duke, 2014).

Tuckman's Stages of Change

Understanding the impact of change within a school is key to implementing a program with fidelity and achieving the desired outcome of an intervention. The effects of change may not be immediate and, as stated earlier, taking the time to align all parts of a system can substantially increase program fidelity and the effectiveness of an intervention. As Tuckman's (1965) Stages of Change help illustrate, there are distinct phases of change that can occur as a school works towards program fidelity. When put in the context of a school, these four stages (forming, storming, norming, and performing) help illustrate the process of adopting, implementing, and refining the intervention in support of the school's overall mission and vision.

The initial stage of Tuckman's model (forming) represents the beginning stages of change. This phase typically represents the awareness and decision-making process of adopting a new program or intervention (Tuckman, 1965). It is at this stage that leadership plays an essential role and is looked upon to help answer questions and to make decisions regarding program adoption. Authentic leadership qualities described by Tonkin (2013) help demonstrate transparency and balanced processing. Ensuring buy-in means transparency must be evident. Openness to the ideas of others and actively seeking advice and feedback is key to building the foundation necessary for change to occur. Demonstrating a clear alignment between a school's vision and mission helps to build a sense of transparency, and is a critical factor in its overall success.

The initial stage of change is followed by storming (Tuckman, 1965). The storming stage typically begins during the initial implantation of a new program or intervention. During this stage, teachers are doing things (such as implementing a new curriculum) that might make them feel unsure or uncomfortable. The system must be strong enough to weather the change because it is at this stage that many initiatives are often abandoned (Tuckman, 1965). Without leadership and the support of key stakeholders during the storming phase, the innovation or new program is at a disadvantage (Onorato, 2013). In the storming stage, concerns can be addressed, and solutions can be identified by looking at problems as they arise through the eyes of the various roles that leaders play in the school: "managerial, instructional, financial, and the overall responsibility in the general oversight of all stakeholders associated with the institution" (Onorato, 2013, p. 34-35).

With strong leadership, storming transitions into norming (Tuckman, 1965). This third stage of change represents established routines and support structures that are supported by the systems within the school. As previously mentioned, when the moving parts of a system are aligned, a shared vision becomes the goal towards which energies are directed (Elmore, 2000; Spillane, 2005). As O'Connell et al. (2010) suggest, a strong vision can have a huge impact on the performance of an organization, often creating a "spark that lifts organizations beyond the mundane" (p. 104). Aligning all the parts of a system through a shared vision positions the school for the final stage of change, performing.

With an effective support structure in place, the results or desired outcomes of the program or implementation becomes evident (Tuckman, 1965). The performing stage of change represents confidence within the systems to achieve the desired results. Establishing an environment driven by a vision allows the system to address both positive and negative intentions and consequences associated with program implementation and fidelity. Driven by transformational and authentic leadership, the organizational system can shift to a distributed leadership model so that all stakeholders know their role in making the vision a reality for the school. Figure 2.3 illustrates Tuckman's stages of change showing the distinct implementation dip that can occur as all microsystems work through the roadblocks associated with learning and applying new information (Fullan, 2001).

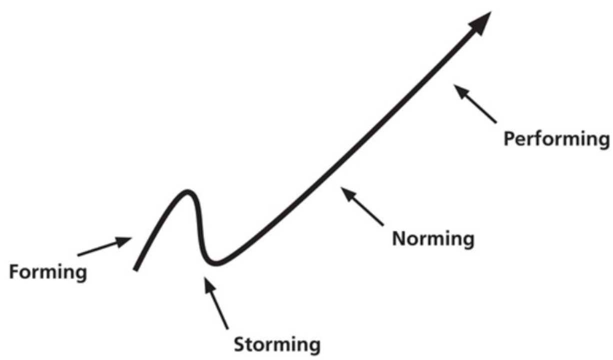

Figure 2.3. A graphical representation of Tuckman's Stages of Change. Adapted from *PowerTeaching Math guide: A comprehensive resource for teachers and leaders, 3rd Edition* (p. 152), by Success for All Foundation, 2015. Copyright (2015) by Success for All Foundation, Inc. Adapted with permission.

Concerns-Based Adoption Model (CBAM)

While Tuckman's (1965) stages of change help demonstrate the distinct phases that occur when schools implement a new program or intervention, a more detailed description of each stage is provided by the Concerns-Based Adoption Model (CBAM) (Hall & Hord, 2001). CBAM has three diagnostic elements – Levels of Use (LoU), Stages of Concern (SoC), and Innovation Configurations (Hall & Hord, 2001). Similar to the Tuckman model, an awareness of these elements can help school leadership predict and address the needs of teachers as they implement programs and select interventions that support students' needs.

Levels of Use provide an additional dimension to understanding the stages of change described by Tuckman (1965). There are eight distinct levels in the change process described by Hall and Hord (2001). These levels range from Level 0 (non-use) to Level 7 (renewal). Table 2.1 provides a summary of each stage as defined by SFAF (2015).

Table 2.1

Concerns-Based Adoption Model Aligned with SFAF's Whole School Approach - LoU

Level of Use	Description
0	Nonuse: Staff members are unaware of programs or have no involvement with them.
I	Orientation: Staff members are learning about a new program, exploring program requirements, and evaluating the programs' overall value and fit with their school.
II	Preparation: The school has adopted one or more programs and is preparing for a first-time implementation. School leaders and others have participated in the initial training. Teachers are studying curriculum materials and organizing their classrooms. Math Leaders team members have been selected and trained. Program scheduling and materials organization is complete. Member Center is being used, and data is entered.
III	Mechanical Use: Teachers begin to teach the program. First attempts may result in disjointed or awkward instruction. Teachers may feel clumsy, have pacing problems, or follow manuals very closely. Everything is new and awkward. This level coincides with the storming phase in the Tuckman model. Teachers and other staff often experience discomfort during this stage because of the stress of trying to master new material and routines. As a consequence, they need a high level of support and reassurance.

Table 2.1 (continued)

Level of Use	Description
IV	Routine: The pieces are starting to come together. Teachers are moving smoothly through lessons and planning and implementing program essentials, and school leaders are comfortable fielding questions and offering support. Teachers and other staff often feel a certain amount of relief now that they are through their initial discomfort. Their focus remains more on process than on student outcomes, on teaching rather than on student learning. School leaders need to make sure that the school does not stagnate at a routine level, but that it seeks to make a stronger connection between instruction and achievement. Math Leaders team is meeting regularly, and Component meetings are occurring and following the basic component meeting agenda. Teachers are collecting and entering Data into Member Center.
V	Refinement: Teachers focus on the connections between instruction (process) and student achievement (results). They are able to adjust instruction to meet the needs of individual students, using formal and informal assessment data as their guide. As teachers reach the refinement level, their students will start to show dramatic gains in achievement. Math component teams are forums for real review of data on goals and targets. Quarterly Data Review meetings are energetic, creative and result in creative problem-solving that addresses challenging issues to promote greater achievement.
VI	Integration: Teachers and other staff combine efforts to achieve a collective impact on student performance. Teachers discuss student data and strategies to individualize instruction, and they develop an interest in other components. The focus is no longer on their own students or their own area of expertise, but on collaborating with other staff members to ensure the success of every student. Real alignment among all school resources happens here.
VII	Renewal: Schools seek major ways to improve the implementation of programs, focusing on schoolwide goals and benchmarks. A culture of mutual accountability exists among grade levels, math teachers, and school leaders. This is the stage when change becomes self-sustaining. Structures have been put into place, so the program is now how the school does business, and the business is to promote achievement for every student.

Note. Reproduced from *PowerTeaching Math guide: A comprehensive resource for teachers and leaders, 3rd Edition* (p. 154-155), by Success for All Foundation, 2015. Copyright (2015) by Success for All Foundation, Inc. Reproduced with permission.

In addition to the LoC, CBAM's SoC (Hall and Hord, 2001) identify the areas of personal concern that educators typically experience during the change process. The SoC is useful in identifying the type and level of support that a teacher may need at any given moment. SoC can be categorized into three elements – self, task, and impact. As with Tuckman's model and the LoU, school leadership's awareness of these levels can help provide appropriate supports to teachers experiencing change as they implement a new program or intervention (Hord, Rutherford, Huling, & Hall, 1987). Table 2.2. provides a summary of the SoC as defined by SFAF (2015).

Table 2.2

Concerns-Based Adoption Model Aligned with SFAF's Whole School Approach – SoC

	Stage of Concern	Description
Self	Stage 0: Awareness	Gaining an awareness of a program or intervention.
	Stage 1: Informational	Learning more about a program or intervention (e.g., goals and outcomes).
	Stage 2: Personal	Questioning the impact of the program on oneself.
Task	Stage 3: Management	Working through the logistics of the program or intervention and understanding how it works.
	Stage 4: Consequence	Questioning the initial results of the program or intervention.
Impact	Stage 5: Collaboration	Beginning to work with others to problem-solve and refine implementation.
	Stage 6: Refocusing	Using results to identify and refine best practices associated with the program or intervention.

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The final aspect of the CBAM model, innovation configurations, provides leaders with a roadmap of what constitutes high-quality program implementation. This roadmap can provide guidance and support that schools can use as they weather the stages of change described by Tuckman (1965) by providing “impact points for facilitating implementation of research-based practices and programs in classrooms and schools.” (Roach, Kratochwill, & Frank, 2006, p. 300).

Leadership’s Role in Promoting and Supporting Change

School leaders are the key to a successful school and program implementation (Fullan, 2007; Marzano, Waters, & McNulty, 2005). Part of being an effective leader is not only the ability to lead and inspire others as they weather change, but to reflect on one's actions in the hopes of continuous improvement (Nesbit, 2012). Principals who adopt a whole school reform model understand the importance of working effectively with their teachers. Outcomes of reforms or programs are often based on the relationship between teachers’ knowledge and skill, student-learning needs, and subject matter (Scribner, 2002). Thus, it is a principal’s role to support teacher development so that a school’s instructional capacity can be expanded and refined (Spillane & Louis, 2002).

As principals define their roles within schools, leveraging both transformational and authentic leadership approaches can help better establish a vision and mission that can provide strategic direction (Onorato, 2103; Tonkin, 2013). While an authentic leader is more open to the reality of the situation and will share realities of the situation at hand to build trust and transparency, a transformational leader may present only the information that supports the vision. An authentic leader is open to showing faults behind the scenes and is willing to engage others in decisions to help share the burden of achieving the vision and mission (Tonkin, 2013).

Without strong leadership, schools may struggle to implement a new program or intervention as they support their teachers through the change process. In many ways, being able to inspire and lead others is key to achieve the vision and mission of the school and to support the fidelity of programs or interventions. As Setters and Field (1990) describe, “leadership not only rests on the shoulders of one individual but also all who share in the mission and vision” (p. 38). By establishing such an environment, a principal can influence others in pursuit of the mission and vision, creating a culture of highly motivated individuals (House & Aditya, 1997). As House and Aditya (1997) explain, “high achievement motivated individuals engage spontaneously in a high degree of self-regulatory behavior… without training and direction from others” (p. 413). Establishing systems and processes enable an effective leader not to be “personally involved in performing the work… and be reluctant to delegate authority and responsibility” (House & Aditya, 1997, p. 413) supporting the notion that problems reside in the system, not in the people.

Leveraging Distributed Leadership

Achieving goals through systems alignment requires the dedication of the school leaders. Since the whole school reform movement of the 1990’s, teachers have played an increasing role in program adoption, decision making, and peer mentoring (Ovando, 1996). This increase in responsibility puts matters of instruction in teachers’ hands allowing for more ownership over school governance and organization (Miller & O’Shea, 1992). Utilizing a distributed leadership model helps build and enable systems to achieve results even if the principal or leadership changes (Hutchens, 1994). Distributed leadership can build greater ownership throughout the school community and can offer a more realistic approach toward implementing a program with fidelity. A great deal of the empirical research on distributed leadership models centers around how to create fundamental change in school leadership structures rather than on just expanding task assignments at the teacher level (Bennett, Wise, Woods, & Harvey, 2003). The key to success is when the principal employs a clearly defined collaborative leadership structure in which focus, clear communication, and accountability for implementation fidelity and program results are maintained (Angelle, 2010). As Angelle (2010) suggests, organizational structures built on trust and relationships influence teacher efficacy, increased trust, job satisfaction, and teacher retention. Distributed leadership, however, has been criticized by some as a passive and unproductive type of leadership (Hinkin & Schriescheim, 2008). Hoy & Miskel (2012) suggest that within a distributed leadership model, leaders are commonly active only when there are concerns for which it is typically too late to intervene effectively.

Supporting Change through Situated Learning

In an effort to provide organizational structures built on trust and relationships which impact teacher efficacy, increased trust, job satisfaction, and teacher retention (Angelle, 2010), situated learning can support teachers' learning and development as they implement programs or interventions. Situated learning shares many of the same characteristics as social development theory (Vygotsky, 1962) in that learning is a result of social engagement, where knowledge is co-constructed based on purposeful activities set within a specific context (Lave & Wagner, 1991). Lave and Wagner (1991) proposed that learning is less likely to occur out of context, a notion supported by Brown, Collins, and Duguid (1989) who suggest learning is social in nature and that it will only take place if it is incorporated within the social and physical context that it is used. Put into the context of teacher development, situated learning provides teachers with the opportunity to learn from one another within a culture of practice (Lave & Wenger, 1991). This notion is essential in supporting a whole school reform effort built around a cooperative learning model where fundamental shifts in pedagogy are taking place. As Lave and Wagner argue, as a learner's involvement increases, they move from the role of observer incorporating their newly found knowledge within their current practice, thus increasing the fidelity of program implementation.

Cognitive Apprenticeship

Cognitive apprenticeship is a model of learning that is supported by situated learning theory. By design, the cognitive apprenticeship model supports the notion that shared knowledge and understanding are the results of intentional collaboration **(**Lave, 1993; Lave & Wenger, 1991). Because of this interaction, knowledge is more than an internal process; it is the notion of the learner contributing to a community of practice that supports the notion of intentional learning and development. Lave and Wenger (1991) suggest three elements to cognitive apprenticeship, (1) activities, contexts, and cultures provide a natural environment for learning to occur, (2) natural context and applications provide opportunities for concepts to be identified and developed, and (3) prospects for apprentice-like opportunities are present. These three elements define a community of practice in which the apprentice is exposed to, and learns from, others who have varying skills and knowledge. This notion builds upon Vygotsky's Zone of Proximal Development, in which more experienced members of the community are involved in planning and supporting learning activities.

Stages of cognitive development. As illustrated by Brandt, Farmer, and Buckmaster (1993), cognitive apprenticeship can be broken into five stages: (1)

modeling, (2) approximating, (3) fading, (4) self-directed learning, and (5) generalizing. Modeling provides the opportunity to demonstrate behaviors and new knowledge (Brandt, Farmer, & Buckmaster, 1993). Supported by articulation, reflection, and scaffolding, new information can be assessed by the learner and a plan can be established that gradually limits the supports needed in order to transition ownership to the learner. Through autonomy and practice, the learner can make modifications to their newly acquired knowledge or skills and develop the self-control necessary to make personal adaptations with little or no assistance, resulting in an increase in program fidelity. Through discussion and applications in real-world contexts, the learner can self-reflect and continue to build and refine their learning (Brandt, Farmer, and Buckmaster, 1993).

Professional Development

Professional development is an essential component for whole school reform and program implementation (Guskey & Huberman, 1995). Professional development is defined as a "systemic effort to bring about change in the classroom practices of teachers, in their attitudes and beliefs, and in the learning outcomes of students" (Guskey, 2002, p.381). Situated learning demonstrates that "adult learners approach learning with clear goals in mind, using their life experiences to make sense of new information. They are motivated by opportunities to address problems – and create solutions – that relate directly to their lives." (Hunzicker, 2011, p. 177). To consider professional development authentic and relevant, teachers must feel engaged in learning activities that are "job-embedded, instructionally focused, collaborative, and ongoing." (Hunzicker, 2011, p. 177).

Professional development is an essential element of program implementation and can have an impact on program fidelity (Borko, 2004; Killion, 2016b). Professional development can help to ensure that teachers and school leaders develop and maintain a shared understanding of program goals in addition to a roadmap for adapting existing practices, by scaffolding information that aligns with potential implementation roadblocks. The most effective school programs require professional development as a way of changing instructional practice. This commitment "requires deliberate attention to implementation fidelity of both the content and process of professional development, the ongoing development of professional developers, and the measurement of implementation over time." (Killion, 2016b, p. 56). When schools implement professional development strategically and align it with program design and school goals, teachers have a higher frequency of program implementation and fidelity (Killion, 2016b).

Effective Professional Development

There is a growing body of evidence that supports the relationship between professional development, program implementation (teacher instruction), and student outcomes (Antoniou & Kyriakides,2013; Buysse, Castro, & Peisner-Feinberg, 2010; Campbell & Malkus, 2011; Doppelt, Schunn, Silk, Mehalik, Reynolds, & Ward, 2009; Heller, Daehler, Wong, Shinohara, & Miratrix,2012; May, Sirinides, Gray, & Goldsworthy, 2016; Newman, Finney, Bell, Turner, Jaciw, Zacamy, & Gould, 2012). Effective professional development can be described as "structured professional learning that results in changes in teacher practices and improvements in student learning outcomes." (Darling-Hammond, Hyler, & Gardner, 2017 p. v). Effective professional development not only meets the needs of teachers but is well planned and aligned to program and school goals.

Through a review of 35 methodologically rigorous studies, Darling-Hammond, LaPointe, Meyerson, Orr, & Cohen, (2007) identified seven shared features of effective professional development. These features are (1) content focused, (2) incorporates active learning, (3) supports collaboration, (4) uses models of effective practice, (5) provides coaching and expert support, (6) offers feedback and reflection, and (7) is of sustained duration. Effective professional development is often supported by other system supports (i.e., professional learning communities) that are aligned with a shared school vision. As Darling-Hammond suggests, ensuring "a coherent system that supports teachers across the entire professional continuum, professional learning should link to their experiences in preparation and induction, as well as to teaching standards and evaluation. It should also bridge to leadership opportunities to ensure a comprehensive system focused on the growth and development of teachers." (p. vii).

Effective professional development should be content focused, aligned with the core content and how students learn said content, through the programs that are used (Desimone, 2009). Providing opportunities for teachers to become actively involved in meaningful discussions, content planning, and practice helps establish relationships that support collaboration, problem-solving, and knowledge sharing. This helps not only to support how teachers learn but what teachers need to learn in order to implement programs with fidelity (Garet, Porter, Desimone, Birman, Yoon, 2001). Leveraging models of effective practice help teachers understand program implementation or effective teaching practices. When supported through coaching and expert supports (often associated with the development of content and evidence-based practices), effective professional development incorporates the time needed for feedback and reflection, thus allowing teachers to develop into reflective practitioners that continue to seek assistance and guidance over time, learning to support the notion of learning with and from others every day (Yendol-Hoppey & Dana, 2010).

Leadership Role in Professional Development

A leader's role is to provide the time, resources, and opportunities for professional development to take place – especially when fostering a successful whole school reform model leveraging distributed leadership. To support effective professional development, school leaders must combine traditional leadership duties with particular aspects of teaching and learning. Understanding the importance of effective professional development means that leaders are intentionally involved in curricular decisions and program implementations, and support issues that may arise directly affecting the teachers and students (Cotton, 2003).

Effective school leadership must combine the traditional school leadership duties such as teacher evaluation, budgeting, scheduling, and facilities maintenance with deep involvement in specific aspects of teaching and learning. Effective instructional leaders are intensely involved in curricular and instructional issues that directly affect student achievement and, in many ways, can be defined as the instructional leader for the school (Cotton, 2003). The National Association of Elementary School Principals (2001) describes an instructional leader as one who leads learning communities. "In a learning community, instructional leaders make adult learning a priority, set high expectations for performance, create a culture of continuous learning for adults, and get the community's support for school success." (Jenkins, 2009). In many ways, an instructional leader's role supports that of professional development in that they make suggestions, provide timely feedback, model effective instruction, value the opinions of others, and celebrate effective teaching (Blase & Blase, 2000).

In a case study of two elementary schools conducted by Clement and Vandenberghe (2001) to better understand "how school leaders can influence teachers' professional development positively through the creation of workplace conditions" (Clement & Vandenberghe, 2001, p.45), researchers spent five weeks in each school and found that principal relationships were the key to effective professional development and adult learning. After interviewing the 23 teachers and school leadership, Clement and Vandenberghe (2001) found that a leader's role in the effectiveness of professional development is essential. They also noted, however, that professional development needs to be supported through context, structures, and processes to realize its full benefits.

Professional Development and Program Fidelity

Assessing the impact of professional development on program fidelity can help schools keep professional development topics relevant to teachers needs while supporting program implementation. To assess impact, instructional leaders must understand the transfer of knowledge and its impact within the classroom. Evaluating the transfer of knowledge, however, can be a daunting task. Transfer refers to the "degree to which past learning and new leaning is repeated in similar and new situations." (McDonald, 2009, p. 630). Guskey's (2000*) Five Levels of Professional Development Evaluation* provides a systemic way of evaluating professional development and its impact on program implementation and fidelity. These five levels include (1) participants' reactions, (2) participants' learning, (3) organizational support and change, (4) participants' use of new knowledge and skills, and (5) student learning outcomes. Each level provides implications across the system to make professional development effective in supporting program implementation and fidelity. From helping to improve the design and delivery of programs to confirming the relationships between intent and outcomes, Guskey's (2000) five levels help to ensure professional development is targeted and effective by providing a strategic alignment based on needs. When associated with a program's innovation configuration map, this information can help support teachers LoU and SoC associated with program implementation through Professional Learning Communities (PLCs) and coaching. By identifying factors that exist within an organization that are prohibiting program implementation, a strategic plan can be constructed that can directly addressing factors (e.g., beliefs, behavior, and culture) that are prohibiting new information and skills from being learned, applied, and refined.

Professional Learning Communities

Situated learning and professional development provide the foundation for knowledge and skill development collaboration. Within schools, Professional Learning Communities (PLCs) can be established as a means of structuring opportunities for teacher collaboration, knowledge development, and addressing the challenges that are associated with a whole school reform model and program implementation. PLCs are driven by school leadership and originate from Professional Learning Networks (Singe, 1990) in which learning organizations achieve results through collaboration. PLCs rely heavily on the establishment of a vision and mission that drives a need for continuous improvement (DuFour & Eaker, 2010). This notion reinforces the aforementioned systems approach and allows for all members of the school to work toward a common goal, especially within turnaround schools where school attrition, low student performance, and a lack of teacher experience are contributing factors to the overall problem under discussion. PLCs promote collective responsibility for the development of each student (DuFour, 2004; King & Newmann, 2001) while creating reflective practitioners who seek and share knowledge regarding program implementation through collaboration and problem-solving (DuFour, 2004; Hord, 2004).

As Westheimer (1999) suggests, PLCs are supported by five traits: (1) shared beliefs, (2) participation and interaction, (3) interdependence, (4) concern for individual and minority views, and (5) meaningful relationships. These five traits support DuFour's (2004) suggestion that action research should support collective professional learning. As Bryk, Camburn, and Seashore (1999) note, "by far the strongest facilitator of professional community is social trust among facility members. When teachers trust and respect each other, a powerful social resource is available for supporting collaboration and reflective dialog" (p. 767).

PLCs provide teachers with a sense of purpose while promoting efficacy through collaboration and problem-solving (Andrews & Lewis, 2007). In a study of Innovative Designs for Enhancing Achievement in Schools (IDEAS), Andrews and Lewis (2007) highlight the power of developing PLCs based on shared purpose and identity on student learning outcomes, relationships with the community, and the alignment of school operations. In their study, Andrews and Lewis used classroom observations and semi-structured interviews with teachers and administrators to conclude that teachers who established PLCs based on a shared vision and mission, not only enhanced their skills and knowledge but had a statistically significant impact on their classroom practices.

In today's digital age, virtual PLCs offer new ways of supporting teacher collaboration and skill development using Web-based tools and mobile communication technologies (Blitz, 2013). Virtual PLCs provide the opportunity for teachers to reflect and collaborate asynchronously, eliminating the need for common plan time and space while providing the opportunities to include subject matter experts that may not be school-based (Beach, 2012). As empirical research suggests, virtual PLCs provide multiple opportunities for teachers to collaborate, problem-solve and learn from one another (Tsai, Laffey, & Hanuscin, 2010). The lower cost associated with virtual PLCs and the demands of traditional professional development that requires extensive planning and scheduling makes them more attractive to schools (Beach, 2012; Hodes, Foster, Pritz, & Kelley, 2011). In addition, virtual PLCs have the ability to create opportunities for individuals to share knowledge and beliefs regarding program implementation with others who may be struggling. In a year-long ethnographic case study design, Curwood (2011) found that technology-focused learning communities had the ability to meet individual teacher's needs and that their participation in online collaboration directly impacted the way in which technology-driven interventions were implemented in the classroom to promote collaboration and knowledge sharing among students. This finding is echoed by Harlen & Doubler (2004) who explored the online and offline versions of the TryScience course and its impact on teacher knowledge and program fidelity. By design, the TryScience course had a collaboration module and, using a mixed methods approach, data from the system was analyzed, and it was determined that on average, online participants spent two or more hours a week engaging in activities to support their learning. Harlen & Doubler (2004) concluded that teachers who participated in the online activities became more reflective towards program implementation than those who were not engaged in the online community.

PLCs can also have an impact on culture. As illustrated by an eight-month mixed method study on school culture and its impact on technology integration and program implementation, Kitchenham (2009) found that school culture, developed through PLCs, had an effect on the transformation of teacher knowledge and the fidelity of technology used to support student learning. The study used Tomei's (2002) standardized Technology Facade Checklist to create a profile of a school's current level of technology use in relation to program implementation based on information gained from the principal. The instrument consists of 20 items based on three elements (1) use of technology, (2) technology infrastructure, and (3) instructional strategies. King's (2002) Learning Activities Survey – Professional Development Technology (LAS-PD TECH) was modified and used as the teacher questionnaire. This provided opportunities for teachers to give more authentic responses regarding their experiences described in the statements. Teachers were also individually interviewed using a semi-structured interview approach. Results of the questionnaires and interviews were divided into themes and elements of perspective transformation. Hargreaves' (2003) model of school culture is used by the researchers to describe the fidelity of technology integration that occurred within schools.

PLCs and Systems

As empirical research suggests, PLCs can have a broad impact on teacher development, school culture, program fidelity, and student achievement outcomes (Andrews & Lewis, 2007; DuFour, 2004; Hord, 2004; King & Newmann, 2001; Senge, 1990; Westheimer, 1999). Aligning all the parts of a system can substantially increase the power of an intervention, and making student learning the central focus gives way for greater stakeholder buy-in. Having a clear vision for PLCs can support their overall efforts. As the Annenberg Institute for School Reform suggests:

> PLCs can be school-based, district-based, cross-district or national; the membership in a particular PLC is determined by its focus. For example, a grade-level team of teachers may form a PLC to focus on improving their ability to coordinate their students' curriculum; a multigrade group of teachers may collaborate on ways to ensure a coherent learning pathway for their students; a group of math teachers may work together to adopt and implement a new mathematics program in ways that best benefit their students; teachers and administrators may meet as a PLC to learn and support innovative teaching strategies; principals or superintendents may concentrate on more effective ways to handle the particular challenges of their roles; a school system may meet regularly with core district representatives to improve operational effectiveness and to build capacity to support school and district efforts to improve schools; groups may form across districts, often as part of a national school reform initiative, to focus on common issues in their work. (Annenberg Institute for School Reform, 2003, p. 2)

With the primary focus of PLCs being to support teacher professional development and school improvement, the school leader has an obligation to identify the necessary support structures to make them most effective (Dufour & Eaker, 1998; Hord, 2004; Murphy & Lick, 2004). Alignment to schools' strategic plans, including teacher professional development and use of student data, is essential in order for members to take collective responsibility for student learning and achievement (King & Newman, 2001).

Focusing PLCs with Data-Informed Decision-Making

Using data to drive instruction has been a key element of educational reform (Marsh, Pane, & Hamilton, 2006). Student achievement data, aligned with high-stakes assessments, provide a primary indicator of student, teacher, principal, and school effectiveness (Cravens, Chen, Porter, Elliott, & Carson, 2009). Aligning data with a schools' vision and mission can provide a systems-aligned approach which will inform and drive teacher decisions and instruction (Shen & Cooley, 2008; Supovitz & Klein, 2003; Wohlstetter, Datnow, & Park, 2008). Using a data-informed decision-making approach provides an additional layer of structure to help support PLCs and align their intended outcomes with a school's vision and mission (McLaughlin and Talbert, 2001). Through the alignment of all processes and procedures that influence program implementation and student learning, PLCs are used to prioritize data and identify the root causes to be addressed by the community (Senge, Cambron-McCabe, Lucas, & Kleiner, 2000). As Schildkamp and Kuiper (2010) illustrate through an explorative study, teachers mainly use classroom data to inform their instructional practice, and school leadership generally uses school-level data to inform policy. Their work illustrates a disconnect between the realities of the classroom and policy that is intended to support teachers and their efforts. Wayman, Cho, and Richards (2010) argue that when teachers and administrators work together to establish goals, they have a better understanding of program fidelity and data and use it in supporting student learning. PLCs also allow for multiple measures of data to be used to identify areas of need and further drive instruction (Bernhardt, 2004).

Coaching

An essential element of the success of PLCs is coaching (Coburn & Russell, 2008). Coaching provides the opportunity to support the five stages of cognitive development that can occur through PLCs (Brandt, Farmer, & Buckmaster, 1993) and is frequently used by many schools to support teachers' learning and development as they implement new programs. Despite the various approaches utilized by schools, coaching is seen as a powerful form of professional development that can support the growth of teachers and administrators as they work to meet the needs of their students (Killion, 2016a). The theoretical framework of coaching is rooted in sociocultural theories (Bodrova & Leong, 2007; Vygotsky, 1978; Wertsch, 1991), utilizing practices that encourage change, facilitate discussion, mediate reflection, and increase impact. For example, in a study of novice teachers seeking certification through alternative routes, those who participated in e-coaching opportunities reported higher self-efficacy in student engagement, instructional strategies, and classroom management (Anthony, Gimbert, Fultz, & Parker, 2011). Similarly, in a three-year randomized control study measuring the impact of instructional coaches in relation to student achievement, there was a significant impact in years two and three attributed to the inclusion of a mathematics coach (Campbell & Malkus, 2011). These findings were similar to a randomized control study of the Responsive Classroom (RC) approach conducted by Griggs, Rimm-Kaufman, Merritt, & Patton, (2013), who found that coaching and teacher training impacted the relationship between anxiety, self-efficacy, effective classroom systems, and program fidelity. Coaching allows teachers to establish a deeper sense of self-reflection, develop emotional and social skills, gain a greater sense of self and social awareness, and utilize a more collaborative approach to supporting the vision and mission of the organization or school (Patti, Holzer, Stern, & Brackett, 2012).

Multiple levels of coaching can exist within a school using a distributed leadership model supported by PLCs. As Batt (2010) suggests, three coaching techniques can be used to support the implementation of an intervention. These three techniques are (1) exploration, (2) critique, and (3) reflection (Batt, 2010). Batt (2010) found that coaching increased the implementation of an intervention from 53% to 100%. Batt's mixed-methods study looked specifically at the role that cognitive coaching plays in the implementation of a model designed to assure effective instruction of culturally and linguistically diverse students. The study took place in two phases collecting data from a knowledge test, surveys, and interviews. The first phase collected data from a pre-post knowledge/skills assessment, and an evaluation survey of a summer SIOP training. Phase two focused on obtaining qualitative data on cognitive coaching through semi-structured interviews. Open-ended survey questions were used to investigate how the coaching process influenced teachers' instructional practices as well as student learning. All evaluation tools were designed, and data was coded and analyzed, by the researcher. Data was analyzed across categories and subcategories, which resulted in overarching themes associated with the coaching process confirming the general benefits of coaching and mentoring (Costa & Garmston, 1994). Similarly, Franklin et al. (2001) found that k-6 grade teachers overcame barriers to implementation in schools and learned how to integrate program resources into their lessons through coaching and collaboration. The theoretical framework of the coaching model was rooted in sociocultural theories (Bodrova & Leong, 2007; Vygotski, 1978; Wertsch, 1991) utilizing practices that (1) encourage change, (2) facilitate discussion, (3) mediate reflection, and (4) increase impact. Data was collected through observations, interviews, and examination of artifacts (i.e., emails, lesson plans, and reflections). Multiple validity measures were taken by the researcher to ensure that the data was coded effectively, and a recursive analysis was used to reveal patterns or trends in coaching practices. Interviews were used to triangulate the data. Results of the study found that the coaching model represents the intentional scaffolding provided by coaches as teachers became more confident in their abilities. Through collaboration, experience, knowledge sharing, problem-solving, and reflection, the coaching dynamic shifted.

Conclusion

Aligning all the parts of a system can substantially increase the power of an intervention, and making program implementation and student learning the central focus gives way to greater buy-in and program success. Leadership's role in supporting teachers learning and development can have a profound impact on program fidelity. Utilizing various models of support can influence teacher efficacy and program fidelity, produce systems change over time, and ultimately build internal capacity within a school (Hamilton, Shanley, Dailey, & McInerney, 2013). Leveraging transformational, distributed and instructional leadership can help school leaders understand how professional development, PLCs, and coaching can support teachers learning and knowledge sharing that impacts program implementation and fidelity. Applying general systems theory to the stages of change (Tuckman, 1965) that occur when programs are adopted can also help school leaders understand the implementation process while the stages of concern, levels of use, and innovation configurations (Hall & Hord, 2001) can support teachers as they weather the highs and lows of adopting a new program.

Chapter 3 provides a purpose, rationale, and design of a secondary analysis of data collected as a part of a three-year randomized controlled trial and a scale-up study of the PowerTeaching Math program so that the relationships that exist between leadership, schoolwide supports, and program fidelity can be further explored.

Chapter 3 – Methodology

The following chapter includes the purpose, rationale, and design of a secondary analysis of existing program data to determine if relationships exist between school leadership, schoolwide supports, and program fidelity. Data used for this analysis was made available by the Inter-university Consortium for Political and Social Research (ICPSR), a unit within the Institute for Social Research at the University of Michigan. The purpose of this analysis was to generate new findings associated with variables (i.e., leadership, schoolwide supports, and program fidelity) not explored by the original study.

Background Information on the MDRC Study

In 2016, MDRC, a non-profit research organization, completed a three-year randomized controlled trial and a scale-up study of PowerTeaching Math to determine the program's impact on standardized math test scores at the middle school level (Grossman, 2018). The study was funded by a five year $25 million Investing in Innovation (i3) scale-up award supported by the U.S. Department of Education. The study included 58 schools that were randomly assigned to the program (n = 30) or to control groups (n = 28), with another 71 schools added over the course of the five-year grant period (see Appendix A for a copy of the MDRC study report).

The Purpose for Conducting a Secondary Data Analysis

The purpose of the secondary data analysis was to explore the relationship between school leadership, schoolwide supports, and program fidelity, and to generate new findings associated with the PowerTeaching Math program elements not explored in the original study.

The Rationale for Conducting a Secondary Data Analysis

A secondary analysis study serves an important function in educational research (Burstein, 1978). As Hakim (1982) describes, a secondary analysis is "any further analysis of an existing dataset which presents interpretations, conclusions or knowledge additional to, or different from, those presented in the first report on the inquiry as a whole and its main results" (Hakim, 1982, p. 1). With multiple years of data now available for public use through the ICPSR, the randomized controlled trial and the scale-up study data of the PowerTeaching Math program serves as a vehicle to explore the relationships between school leadership, schoolwide supports, and program fidelity.

Strengths and Limitations of a Secondary Analysis

As with any research, there are strengths and limitations to conducting a secondary analysis. As Glass (1976) states, "in educational research, we need more scholarly effort concentrated on the problem of finding the knowledge that lies untapped in completed research studies" (p. 4). With a vast amount of untapped data from the three-year randomized controlled trial and scale-up of the PowerTeaching Math program freely available to the researcher and program developers, it makes sense to continue to explore the program variables so that new findings can be used to create or modify the program supports. The data available was cleaned by researchers at MDRC, and detailed documentation about the data collection and cleaning process has been provided in accordance with ICPSR regulations. However, the data available was not originally collected to address the particular research question or to test the particular hypothesis being investigated (Cheng & Phillips, 2014). Because of this, it is common for some important variables to be unavailable for the analysis. "Another problem is that to protect the confidentiality of respondents, publicly available datasets usually delete identifying variables about respondents, variables that may be important in the intended analysis such as zip codes, the names of the primary sampling units, and the race, ethnicity, and specific age of respondents. This can create residual confounding when the omitted variables are crucial covariates to control for in the secondary analysis." (Cheng & Phillips, 2014, p. 374). Fortunately, the researcher and program developers were highly engaged with the original study and have a clear understanding of the study-specific nuances or anomalies in the data collection process that helped with the interpretation and creation of specific variables in the dataset.

Procedure for Conducting a Secondary Analysis

Traditional research methods typically help a researcher identify ways to collect, analyze, and interpret study data (Cresswell, 2009). When conducting research using secondary data, the area of interest and research questions play a vital role in identifying the methods used in conducting the analysis. Frameworks, however, to help guide secondary data analysis methods are limited despite the approach being recognized as an empirical exercise that contains both procedural and evaluative steps (Andrews, Higgins, Andrews, & Lalor, 2012; Doolan & Froelicher, 2009; Smith et al., 2011). Johnston (2013) describes a three-step approach for conducting secondary analysis "that begins with the development of the research questions, then the identification of the dataset, and thorough evaluation of the dataset" (p. 620). Johnston's (2013) three steps were employed to help guide this secondary analysis.

Research Questions and Hypothesis

Applying the theoretical knowledge of a program approach and analyzing hypothetical situations and abstract concepts is a way to compile insight into program implementation and to identify research questions for secondary analysis (Johnston, 2013). As described in Chapter 2, the PowerTeaching Math program design centers around the SFAF's schoolwide ecosystem. SFAF's ecosystem is comprised of three main elements: (1) leadership, (2) schoolwide supports, and (3) instructional approach. Having not been a focus in the original study, research questions for this study focused on leadership, schoolwide supports, and program fidelity. Using qualitative program implementation data, a correlational analysis was conducted to determine the relationships between the program variables by providing statistical descriptions and hypothesis testing (Bernard, 2013). Utilizing the existing literature discussed in Chapter 2, the development and testing of various hypotheses using a statistical analysis helped answer the research questions (see below) and determine the extent and nature of the relationships that exist between program variables so that generalizations and future program decisions can be made (Stone-Romero, 2010).

A correlational analysis can be retrospective, prospective, or descriptive (Welford, Murphy, & Casey, 2012). When exploring the relationships between variables, descriptive correlational research replaces independent and dependent variables with predictor and outcome variables (Welford et al., 2012). For this study, school leaders' engagement was the predictor variable, and comprehensive schoolwide support systems and program fidelity were outcome variables. Operational definitions of these variables are detailed further in this chapter.

Questions

RQ1. Is there an association between school leaders' engagement and comprehensive schoolwide support systems in schools implementing PowerTeaching Math?

$H_0 1$: There is no association between school leaders' engagement and comprehensive schoolwide support systems in schools implementing PowerTeaching Math.

$H_1 1$: Schools with a highly engaged school leader will have more robust levels of comprehensive schoolwide support systems than schools without highly engaged leaders.

RQ2. Is there an association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math?

$H_0 2$: There is no association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math.

$H_1 2$: Schools with a highly engaged school leader will have a higher level of program fidelity than schools without highly engaged leaders.

RQ3. How prepared did school leaders say they felt to support the implementation of PowerTeaching Math at the study schools?

RQ4. What steps did school leaders report taking at the study schools to implement PowerTeaching Math?

Identification of Dataset

Conducting a secondary analysis of the PowerTeaching Math program study data was a way to understand the relationships between leadership, schoolwide supports, and program fidelity. Data from the MDRC study was made available by the Inter-university Consortium for Political and Social Research (ICPSR), a unit within the Institute for Social Research at the University of Michigan. Considering the use of previously collected data for analysis concerning a given topic is considered an effective means of program analysis and continued research (see Dale, Arbor, & Procter, 1988; Doolan & Froelicher, 2009).

Evaluation of the Dataset

Stewart & Kamins (as cited in Johnston, 2013) outline six questions that should be answered to determine a dataset's quality and appropriateness for the research questions identified for secondary analysis. The six steps are: (1) what was the purpose of the original study; (2) who was responsible for gathering the data; (3) what data was collected during the study; (4) when was the data collected; (5) how was the data obtained; and (6) how reliable is the information got from one source with information obtainable from other sources?

Data from the MDRC PowerTeaching Math program study was made available by the ICPSR and, as described by Grossman (2018), "the ten data files included in this study contain a range of variable information gathered from student-level test scores, teacher and school principal surveys, school achievement snapshots, teacher logs, and scale-up initiative evaluations. Key variables include district IDs, teacher and principal IDs, baseline and outcome standardized test scores, structural and instructional processes, and records of teacher logs. Demographic variables for students include information on race, gender, special education, free/reduced lunch eligibility, ELL status, and age."

(para. 3). Appendix B provides a complete guide to the Study Documentation and answers to the six steps outlined by Stewart & Kamins.

Identifying Specific Data for the Secondary Analysis

The MDRC evaluation did not use the full scope of data collected to answer the original research questions. This unused data provides a repository for pursuing answers to the research questions above (Heaton, 2008, Johnston, 2012; Smith, 2008). As a means of focusing the dissertation study, the secondary analysis was limited to the program (n = 30) and to scale-up schools (n = 41) that implemented the PowerTeaching Math program in the 2015-16 school year. These 71 schools had implemented the PowerTeaching Math program for at least two years, and some of their data were not included in the MDRC study or results (specifically the principal school surveys).

Identifying a Data Focus to be used for the Secondary Analysis

With a clearly defined data scope and focus, data from the individual school achievement snapshots for the AY 2015-16 was used to answer RQ1 and RQ2. Of the 71 possible schools, datasets were available for 68 schools (30 program and 38 scale-up schools) to bring the total n for the secondary analysis to 68. Data obtained from the 2015-2016 school principal survey (available for the program schools only) was used to answer RQ3 and RQ4. Twenty-seven surveys (out of a possible 30) were available for analysis. An overview of the two study instruments follow.

School Achievement Snapshot.

The school achievement snapshot is a form created and used by SFAF to monitor a school's progress in implementing various programmatic features of its various programs. Used for over 25 years to help support and guide implementation, the school achievement snapshot is completed five times a year (baseline, quarter 1, quarter 2, quarter 3, and quarter 4) by an SFAF implementation specialist in coordination with the school's leadership team. (See Appendix C for a copy of the school achievement snapshot and Appendix D for a complete list of school achievement snapshot items used for this analysis).

The schoolwide snapshot clarifies the expectations of the PowerTeaching Math program. Collectively, all of the Snapshot objectives represent a full and complete use of the program that results in the highest levels of student achievement. Ideally, SFAF coaches and math leaders work together to review and verify ratings for three categories of objectives: (1) schoolwide structures, (2) instructional processes, and (3) student engagement. Priority levels are assigned to the Snapshot objectives to guide the order of focus (i.e., (1) mechanical, (2) routine, or (3) refined). These priorities aligned with the CBAM (see Hall & Hord, 2001, 2011) guide users to know which objectives they should consider first, especially when first implementing the program. As explained by the program developers, most schools are not expected to address all objectives immediately and perhaps not even all at one time. Once a school has everyone implementing objectives assigned to the mechanical level, they will maintain those objectives while the school moves on to routine objectives (while also working on objectives that are classified as a refined priority). Even experienced schools find themselves revisiting all objectives, especially with new classes, at the beginning of the year or with new teaching staff (SFAF, 2015).

Ratings for each school achievement snapshot item is based on observation, discussion, meeting notes, classroom samples, and other artifacts, such as team score sheets, math facilitator observation records, videos, audio records, transcript of instruction, or teacher-generated records of student responses. For all school achievement snapshot items, the rating is either “In place” (IP) or “Not in place” (N). For the purpose of this study, ratings were assigned to a scale of 1 (for IP) or 0 (for N). Specific expectations for all math items are explained in Appendix D.

Cronbach’s alpha was used to test the internal consistency of the school achievement snapshot. The school achievement snapshot consisted of 14 items (used in the MDRC study) and was found to be highly reliable (14 items; α = .86). Cronbach's alphas for the 8 schoolwide support and 6 instructional process items were .75 and .91, respectively. Figure 3.1 illustrates sample schoolwide structure items found on the schoolwide achievement snapshot and used as a part of the analysis.

Schoolwide Structures

B	**1**	**2**	**3**	**4**	**IP** = In Place; **N** = Not in Place
Fundamentals					
					❶ All leaders and staff have received essential training. (1)
					❶ Materials necessary for program implementation are complete. (2)
					❶ School-based Math Coach is a full-time position. (4)
					❶ The principal is fully involved with PowerTeaching implementation. (7)
					❶ Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support. (8)

Figure 3.1 Sample items from the schoolwide structures section of the school achievement snapshot. Adapted with permission from *PowerTeaching Math guide: A comprehensive resource for teachers and leaders, 3rd Edition* (p. 189), by Success for All Foundation, 2015. Copyright (2015) by Success for All Foundation, Inc. Adapted with permission.

School Principal Survey

The school principal survey is a 26-question test divided into seven parts administered electronically to principals in both program and control schools (*n* = 30 and *n* = 28 respectively) in the spring semester of the 2015-2016 school year. The school principal survey is comprised of a variety of nominal/descriptive, Likert-type scales, multiple response, and closed and open-ended questions. Schools received compensation for all study activities, resulting in a 97% survey return rate (90% from the program and 100% from the control sites). The school principal survey was created and fielded electronically by the researchers at MDRC. As Grossman (2018) explains, "the original surveys contain several text field responses that are not included in this data to protect principal and school anonymity. The survey data yielded information about principal background information, professional development, general experience with school staff and math programs at school, and experience with math state standards." (p. 14). (See Appendix E for a copy of the school principal survey). Specific references to the common core state standards in mathematics, Florida state standards, and PowerTeaching Math were interchanged based on the school's research classification and the programs standards-based alignment.

Cronbach's alpha was used to test the internal consistency of the school principal survey. The school principal survey consists of 144 questions or items, including 61 Likert scale variables and 83 descriptive/nominal items. The school principal survey was found to be highly reliable (61 items; $\alpha = .81$). The subscale used to answer research question three consisted of 16 items ($\alpha = .91$). Figure 3.2 illustrates question 19 from the school principal survey and sample subscale items used by the researcher to address research question 3.

New Screen

THE [COMMON CORE STATE STANDARDS IN MATHEMATICS]

20. To what extent were you prepared during the 2015-16 school year to do the following?

<Not at all, To a little extent, To some extent, To great extent, Not sure / Not applicable>

a. Convey what the [Common Core State Standards in Mathematics/Mathematics Florida Standards] are about to your teachers and school staff.

b. Influence teachers' motivation to implement the [Common Core State Standards in Mathematics/Mathematics Florida Standards].

c. Clearly communicate to teachers the types of changes required by implementation of the [Common Core State Standards in Mathematics/Mathematics Florida Standards].

d. Prioritize [Common Core State Standards in Mathematics/Mathematics Florida Standards] implementation, given other pressing needs.

Figure 3.2 Question 20 from the school principal survey and sample subscale. Reprinted with permission from "*Group Work Is Not Cooperative Learning: An Evaluation of PowerTeaching in Middle Schools: A Report from the Investing in Innovation (i3) Evaluation*" by Rappaport et al., 2017. Copyright (2017) by MDRC.

Defining New Constructs and Variables for Analysis

Based on the literature, a key predictor variable (school leaders' engagement) and two outcome variables (comprehensive schoolwide support systems and program fidelity) were identified operationalized using groups of snapshot items. Other key factors related to implementation quality were explored using survey data (leaders reported level of preparedness to implement the program, and actions reported taken to support the program). A description and operational definition of each variable follow.

School Leader Engagement. A highly engaged school leader can best be described as the keeper of the vision. A key part in maintaining a school's vision is the ability to set high expectations for the performance of all students and adults in the building. The school leader's job is to make sure that the stage is set to support the

PowerTeaching Math program in their building, monitor and celebrate progress, and keep motivation and energy high. An engaged school leader also helps to:

- Maintain public expectation of quality. Maintaining a clear and public position that quality is the top priority of the school is the best way to ensure a strong implementation.
- Allocate sufficient resources. Allocating school resources is a necessary part of implementing program components according to their design, including financial and physical resources, personnel, and time. It is imperative that the school-based math coach position is maintained, and that time is provided for component team meetings (PLCs), in-service training, and ongoing professional development and support to be provided.
- Safeguard instructional coach time. Successful implementation is strongly related to an empowered instructional coach, so guarding the coach's time is crucial to support and build a high-quality implementation.
- Protect the instructional math coach's role. In addition to protecting the school-based math coach's time, it is important for the principal to protect the school-based math coach's role. The principal should be in charge of teacher accountability to allow the school-based math coach to be a successful coach.

Schoolwide support items one and seven from the school achievement snapshot were used to describe this construct (see Appendix F for a complete list of school achievement snapshot items and guidelines used for this analysis). Schoolwide support items one and seven from the school achievement snapshot assume that (1) all leaders and staff have received essential training, and (2) the principal is fully involved with PowerTeaching Math program implementation.

To operationalize a highly engaged school leader, the two schoolwide achievement snapshot items used to define this construct were weighted 0 or 1 each - for a possible range of 0-2 (with 0 or 1 representing a low level of engagement and 2 representing a high level of engagement).

Comprehensive Schoolwide Support System. A comprehensive schoolwide support system helps to build ownership of processes, programs, and systems within a school. For systems to be effective, the leadership team must make sure that school goals are communicated to all levels of the organization (e.g., teachers, other school staff, parents, and students) and that coordinated resources are provided to support goal attainment. Supports within a comprehensive system include:

- Access to a full-time instructional coach. The overall role of an instructional coach is to monitor schoolwide implementation of the PowerTeaching Math program to maximize achievement for all students through SFAF's continuous improvement approach. They must provide support for the continual improvement of curriculum implementation, the monitoring of student progress, and the planning for individual success. The instructional coach also conducts classroom observations, provides feedback, provides assistance to teachers in using the component data tools, teaches and models lessons, conducts reading classes to release teachers for peer observations, and holds mini-training sessions.

- Regular Component Team Meetings (PLCs). Component team meetings provide an important venue for communication and are held at least twice a month where goal setting and review are the primary focus.
- Ongoing professional development. Professional development is frequently offered (at least once a month), is aligned with school targets, and includes pre-determined action items for accountability and knowledge transfer. The principal should be aware of and support any professional development being presented by the PowerTeaching Math program team.

Schoolwide support items two, four, eight, 22, 34, and 35 from the school achievement snapshot were used to describe this construct (see Appendix G for a complete list of school achievement snapshot items and guidelines used for this analysis). Table 3.1 provides definitions for each school achievement snapshot item used to describe a comprehensive schoolwide support system.

Table 3.1

School Achievement Snapshot Items Used to Define a Comprehensive Schoolwide Support System

Category	Item	Item Description
Schoolwide Supports	2	The program materials necessary for program implementation are complete.
	4	A school-based instructional coach is a full-time position.
	8	Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support.
	22	A classroom assessment summary is submitted quarterly by each teacher.
	34	Instructional component teams set SMARTS targets based on program data, chart progress, and work collaboratively to meet their targets.
	35	The instructional coach uses the GREATER coaching process to support continuous improvement of student achievement through high-quality implementation.

Note. Adapted from *PowerTeaching Math guide: A comprehensive resource for teachers and leaders, 3rd Edition* (p. 198), by Success for All Foundation, 2015. Copyright (2015) by Success for All Foundation, Inc. Adapted with permission.

To operationalize Comprehensive Schoolwide Support Systems, the six schoolwide achievement snapshot items used to define the construct were weighted 0 or 1 each (0 for "Not in Place" and 1 for "In Place") for a possible range of 0-6.

Program fidelity. Program fidelity was defined as "the extent to which delivery of an intervention adheres to the protocol or program model originally developed." (Mowbray, Holter, & Teague, 2003, p. 315). Program fidelity includes not only schoolwide supports but also adherence to the following program elements:

- Teachers use the basic lesson structure and objectives. Teachers use available media regularly and effectively.

- Teachers use Think-Pair-Share, whole-group response, Random Reporter (or similar tools that require every student to prepare to respond) frequently and effectively during teacher presentation.
- Teachers provide time for partner and team talk to allow mastery of learning objectives by all students.
- Teachers facilitate partner and team discussion by circulating, questioning, redirecting, and challenging students to increase the depth of discussion and ensure individual progress.
- Following Team Talk or other team study discussion, teachers conduct a class discussion in which students are randomly selected to report for their teams; rubrics are used to evaluate responses, and team points are awarded.
- Teachers calculate team scores that include academic achievement points in every instructional cycle and celebrate team success in every cycle.

Schoolwide support items two, four, eight, 22, 34, and 35 and instructional process items one, three, five, six, seven, and 10 from the school achievement snapshot was used to describe this construct (see Appendix H for a complete list of school achievement snapshot items and guidelines used for this analysis). Table 3.2 provides definitions for each school achievement snapshot item used to describe program fidelity.

Table 3.2

School Achievement Snapshot Items Used to Define Program Fidelity

Category	Item	Item Description
Schoolwide Supports	2	The program materials necessary for program implementation are complete.
	4	A school-based instructional coach is a full-time position.
	8	Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support.
	22	A classroom assessment summary is submitted quarterly by each teacher.
	34	Instructional component teams set SMARTS targets based on program data, chart progress, and work collaboratively to meet their targets.
	35	The instructional coach uses the GREATER coaching process to support continuous improvement of student achievement through high-quality implementation.
Instructional Process	1	Teachers use the basic lesson structure and objectives and use available media regularly and effectively.
	3	Teachers use Think-Pair-Share, whole-group response, and Random Reporter (or similar tools that require every student to prepare to respond) frequently and effectively during teacher presentation.
	5	Teachers provide time for partner and team talk to allow mastery of learning objectives by all students.
	6	Teachers facilitate partner and team discussion by circulating, questioning, redirecting, and challenging students to increase the depth of discussion and ensure individual progress.
	7	Following Team Talk or other team study discussion, teachers conduct a class discussion in which students are randomly selected to report for their teams; rubrics are used to evaluate responses, and team points are awarded.
	10	Teachers calculate team scores that include academic achievement points in every instructional cycle and celebrate team success in every cycle.

Note. Adapted from *PowerTeaching Math guide: A comprehensive resource for teachers and leaders, 3rd Edition* (p. 199), by Success for All Foundation, 2015. Copyright (2015) by Success for All Foundation, Inc. Adapted with permission.

To operationalize program fidelity, the 12 schoolwide achievement snapshot items used to define the construct were weighted 0 or 1 each (0 for “Not in Place” and 1 for “In Place”) for a possible range of 0-12.

Preparedness. Preparedness refers to the state of readiness felt by school administrators to implement the PowerTeaching Math program. Self-reporting of 16 items using a pre-coded five-point Likert scale on the school principal survey were used to define and operationalize this construct. The five-point scale used the phrases (1) not at all, (2) to a little extent, (3) to some extent, (4) to a great extent, and (5) not sure/not applicable to solicit responses to questions relating to preparedness. Table 3.3 details the questions used to define preparedness.

Table 3.3

Items from the School Principal Survey Used to Define Preparedness

Item	Item Description
20 A	To what extent were you prepared to convey what the program was about to your teachers and school staff?
20 B	To what extent were you prepared to influence teachers' motivation to implement the program?
20 C	To what extent were you prepared to clearly communicate to teachers the types of changes required by the implementation of the program?
20 D	To what extent were you prepared to prioritize implementation, given other pressing needs?
20 E	To what extent were you prepared to support individual change?
20 F	To what extent were you prepared to plan effective professional development to facilitate implementation?
20 G	To what extent were you prepared to provide effective instructional models for teachers to help support the implementation of the program in the classroom?
20 H	To what extent were you prepared to access practical how-to guidance to support the changes necessary to implement the program?
20 I	To what extent were you prepared to make high-quality professional development available to teachers?
20 J	To what extent were you prepared to budget for effective implementation?

Table 3.3 (continued)

Item	Item Description
20 K	To what extent were you prepared to align the school's curriculum and instructional focus with the program?
20 L	To what extent were you prepared to evaluate teachers on the implementation of the program?
20 M	To what extent were you prepared to incorporate the program with new teacher evaluations or other state or national initiatives?
20 N	To what extent were you prepared to assure that standards-aligned programs are in place to positively affect students who struggle academically?
20 O	To what extent were you prepared to integrate the program with other programs that serve English language learners (ELLs), special education students, or students in other subgroups?
20 P	To what extent were you prepared to use expanded learning opportunities (e.g., extended day, after school) to support the program?

Note. Principal survey question 20. Adapted from "*Group Work Is Not Cooperative Learning: An Evaluation of PowerTeaching in Middle Schools: A Report from the Investing in Innovation (i3) Evaluation*" by Rappaport et al., 2017. Copyright (2017) by MDRC.

Actions. Actions are the self-reported steps taken by school principals to implement the PowerTeaching Math program. A multiple select question containing eight statements was used to gain an understanding of the steps taken by school leaders to implement the program. These eight statements were: (1) adjusted our school improvement priorities to accommodate standards-related activities, (2) created a leadership plan, objectives, and a timeline for implementation of the program, (3) modified our mathematics curriculum to align with the program, (4) gathered evidence through lesson plans, walkthroughs, and classroom observations to assess the effects of the program on teaching, (5) identified or purchased new textbooks and curricular materials that were aligned with the program, (6) connected the program with expanded learning opportunities (e.g., extended day, after school, or summer programs) in your school, (7) used expanded learning opportunities (e.g., extended school day, after-school, or summer programs) to support implementation, and (8) sent school math staff to professional development sessions on the program (Rappaport et al., 2017).

Evaluation Research Design

As described by Doolan & Froelicher, (as cited in Johnston, 2013), conducting a secondary data analysis is an "empirical exercise with procedural and evaluative steps, just as there are in collecting and evaluating primary data" (p. 620). To this means, a correlational exploratory research design using quantitative archival data was used to determine if a relationship exists between two or more PowerTeaching Math program variables not explored in the MDRC study, and if so, to what degree the relationship occurs (Creswell, 2003; Price, Rajiv, & Chiang, 2015). A correlational exploratory research design was chosen as a way of exploring relationships among program variables not easily manipulated by a researcher (Cantrell, 2011). By design, this approach does not require a control or comparison group, and no control group was used for this secondary analysis (Cantrell, 2011).

Data Analysis Plan

Data captured from the schoolwide assessment snapshot and school principal survey was exported to SPSS Statistics, Version 25 for Windows software for descriptive and inferential analysis. The data was examined using descriptive statistics, including means and standard deviations. Statistically significant relationships between predictor and outcome variables identified in RQ1 and RQ2 were investigated utilizing a Pearson's correlation. A two-tailed test of significance using *p*-value was used to accept or reject the null hypotheses for both questions (Castellan, 2010). Cohen's *d* was used to determine an overall effect size for RQ1 and RQ2. Descriptive statistics from the school principal surveys were used to answer RQ3 and RQ4 by describing the level of preparedness felt by school leaders (at the study schools) with regards to implementing the program, and the steps school leaders took to implement PowerTeaching Math. Descriptive research helps to capture a moment in time and to help establish a context for the topic under analysis (Bernard, 2013). Descriptive statistics used to address RQ3 and RQ4 include the mean scores for each response to the principal survey questions associated with preparedness and actions reported taken by highly engaged leaders to implement the program. Table 3.4 provides an analysis plan to investigate the four research questions stated earlier in the chapter.

Table 3.4

An Analysis Plan Matrix for Addressing Each Research Question

Research Question	Variable	Operational Definition	Statistical Test	Assumptions	Justification
Is there an association between a school leader who is highly engaged and comprehensive schoolwide support systems in schools implementing PowerTeaching Math?	A school leader who is highly engaged (predictor)	Snapshot schoolwide support items: 1 and 7 Scoring: 0 or 1 per item (0 -2 range)	Pearson's correlation (two-tailed test of significance) Effect size using Cohen's *d*	Pearson's correlation assumptions include: • level of measurement; • related pairs; • the absence of outliers; • normality of variables; and • linearity.	Pearson's correlation is used: • to find a linear relationship between two variables; and • when two quantitative variables are being tested in the research hypothesis.
	Comprehensive schoolwide support systems (outcome)	Snapshot schoolwide support items: 2, 4, 8, 22, 34, 35 Scoring: 0 or 1 per item (0 - 6 range)			
Is there an association between a school leader who is highly engaged and program fidelity in schools implementing PowerTeaching Math?	A school leader who is highly engaged (predictor)	Snapshot schoolwide support items: 1 and 7 Scoring: 0 or 1 per item (0-2 range)	Pearson's correlation (two-tailed test of significance) Effect size using Cohen's *d*	Pearson's correlation assumptions include: • level of measurement; • related pairs; • the absence of outliers; • normality of variables; and • linearity.	Pearson's correlation is used: • to find a linear relationship between two variables; and • when two quantitative variables are being tested in the research hypothesis.

Table 3.4 (continued)

Research Question	Variable	Operational Definition	Statistical Test	Assumptions	Justification
Is there an association between a school leader who is highly engaged and program fidelity in schools implementing PowerTeaching Math?	Comprehensive schoolwide support systems (outcome)	Snapshot schoolwide support items: 2, 4, 8, 22, 34, 35 and instructional process items: 1, 3, 5, 6, 7, 10 Scoring: 0 or 1 per item (0 – 12 range)	Pearson's correlation (two-tailed test of significance) Effect size using Cohen's *d*	Pearson's correlation assumptions include: • level of measurement; • related pairs; • the absence of outliers; • normality of variables; and • Linearity.	Pearson's correlation is used: • to find a linear relationship between two variables; and • when two quantitative variables are being tested in the research hypothesis.
How prepared to support the implementation of the PowerTeaching Math program did school leaders at the study schools report?	Preparedness	School principal survey question 20. Self-reporting of 16 items using a pre-coded five-point Likert scale (not at all, to a little extent, to some extent, to a great extent, not sure/not applicable)	Descriptive and Inferential Statistics	Descriptive statistics: • acceptable mathematical operations Inferential statistics: • acceptable mathematical operations unbiased estimation	Descriptive statistics are used to obtain simple summaries about the sample and the measures. Inferential statistics are used to reach conclusions that extend beyond the immediate data.
What steps did school leaders report taking to implement the PowerTeaching Math program at the study schools?	Actions	School principal survey question 21. Self-reporting using a multiple select question (8 items).	Descriptive and Inferential Statistics	Descriptive statistics: • acceptable mathematical operations Inferential statistics: • acceptable mathematical operations • unbiased estimation	Descriptive statistics are used to obtain simple summaries about the sample and the measures. Inferential statistics are used to reach conclusions that extend beyond the immediate data.

Strengths and Limitations of the Evaluation Research Design

There are several strengths and limitations of a correlational research design using quantitative archival data. In general, correlational research is useful for generating logical hypotheses and helps to identify relationships between independent and dependent program variables. Correlation, however, does not indicate causation between variables limiting the results. Selection or sampling bias and confounding variables are common biases associated with quantitative research (Hollins, Martin, & Fleming, 2010). To mitigate selection or sampling bias, all implementation data for program and scale-up schools were included in the study. It was assumed that confounding variables were reduced though by MDRC during the original study design.

Ethical Considerations

To ensure that the secondary analysis of the PowerTeaching Math program study data was ethical, the researcher obtained the appropriate permission from the Johns Hopkins University Homewood Institutional Review Board (HIRB). (See Appendix I for HIRB permission to conduct research using the secondary data obtained through ICPSR).

Assumptions, Delimitations, and Limitations

Conducting a secondary analysis for a dissertation study comes with various assumptions, delimitations, and limitations. Below, assumptions, delimitations, and limitations are considered.

Assumptions. It was assumed that MDRC validated their study instruments and that the data from the three-year randomized controlled trial and a scale-up study uploaded to ICPSR by MDRC is cleaned and coded in accordance with ICPSR rules and regulations. In addition, it was assumed that all schools involved in the original study were recruited in accordance with the program design that includes a majority teacher vote for program adoption. Through the original study design, common biases (e.g., selection or sampling bias and confounders) were addressed. Also, the study and scale-up schools represent a mix of urban and rural schools across multiple states.

Delimitations. As described earlier in the chapter, the data for the dissertation study was limited to the program (n = 30) and scale-up schools (n = 38) that implemented the PowerTeaching Math program in the 2015-16 school year. These 68 schools had implemented the PowerTeaching Math program for at least two years, and some of their data were not included in the MDRC evaluation results (specifically the analysis of the school principal survey).

Limitations. Data collected for the three-year randomized controlled trial and a scale-up study was clearly defined within the context of the original study. The researcher had no control over possible bias in the original data. Data included in the ICPSR data did not include all school achievement snapshot items developed and utilized to guide and support program implementation by the program developers. Principal survey data was only available for the schools that participated in the original randomized control trial and not the scale-up study. In addition, correlations between leader engagement underestimate the magnitude of the relationship between comprehensive schoolwide supports and program fidelity, because there is a dichotomous measure of a continuous variable.

Conclusion

This chapter described the three-step approach (see Johnston, (2013) taken by the researcher to outline the secondary analysis of the PowerTeaching Math program using archival data obtained through ICPSR. The viability and quality of the original data were determined by using Stewart & Kamins' (1993) six questions for evaluating a data set. A correlational exploratory research design using quantitative archival data was identified as a way to determine if a relationship exists between program variables not explored in the MDRC study. The rationale for this study design was to determine if relationships exist between program variables not explored as a part of the original research, and if so, to what degree the relationship occurs. Investigating the data and addressing the research questions not only helped to explore the relationships between leadership, schoolwide supports, and program fidelity provided insights into the school adaptations that were made by the principal and teachers to support program implementation. Chapter 4 provides a factual reporting of the analysis aligned with each study question.

Chapter 4 – Data Analysis and Results

The purpose of this chapter is to provide an overview of the findings from the secondary analysis exploring the relationships between school leadership, schoolwide supports, and program fidelity, and to gauge how prepared school leaders reported feeling about implementing the program, as well as to identify the steps school leaders said they took in order to implement PowerTeaching Math. The overall goal of this study was to generate new findings associated with the PowerTeaching Math program elements not explored in the three-year randomized controlled and scale-up study by MDRC.

As a means of focusing the dissertation study, the secondary analysis was limited to the program (n = 30) and scale-up schools (n = 38) that implemented the PowerTeaching Math program in the 2015-16 school year. These 68 schools had implemented the PowerTeaching Math program for at least two years, and some of the data collected by MDRC was not included in the original evaluation results (specifically the principal school surveys). Based on the literature, a key predictor variable and two outcome variables were identified. These were operationalized using groups of snapshot items. Other key factors related to implementation quality were explored using survey data.

A correlational research design using archival research data was used to determine if a relationship exists between two PowerTeaching Math program variables and, if so, to what degree the relationship occurred (Creswell, 2003; Price, Rajiv, & Chiang, 2015). This Chapter describes the results of the statistical tests described in the previous chapter to address RQ1, RQ2, RQ3, and RQ4.

Data Analysis Overview

Pearson's correlations were conducted to answer RQ1 and RQ2 in an effort to determine if a relationship between the predictor and outcome variables existed (*r*-value). A two-tailed test of significance using *p*-value was used to accept or reject the null hypotheses for both questions (Castellan, 2010). Cohen's *d* was used to determine an overall effect size for RQ1 and RQ2. Descriptive statistics from the school principal surveys were used to answer RQ3 and RQ4 by describing the level of preparedness felt by school leaders (at the study schools) with regards to implementing the program, and the steps school leaders took to implement PowerTeaching Math. Descriptive statistics used to address RQ3 and RQ4 include the mean scores for each response to the principal survey questions associated with preparedness and measures taken by highly engaged leaders to implement the program.

Research Question 1 Findings

RQ1. Is there an association between school leaders' engagement and comprehensive schoolwide support systems in schools implementing PowerTeaching Math?

$H_0 1$: There is no association between school leaders' engagement and comprehensive schoolwide support systems in schools implementing PowerTeaching Math.

$H_1 1$: Schools with a highly engaged school leader will have more robust levels of comprehensive schoolwide support systems than schools without highly engaged leaders.

For this analysis, school leaders were categorized as having a low or a high level of engagement based on items one and seven from the schoolwide support section of the achievement snapshot items (see Table 4.1). As Table 4.1 illustrates, 24 school leaders were categorized as having a low level of engagement, and 40 school leaders were categorized as having a high level of engagement.

A Pearson's correlation was conducted to examine the association between school leaders' engagement and comprehensive schoolwide support systems (see Table 4.2). Table 4.2 suggests that there is a statistically significant interaction between school leaders' engagement levels and schoolwide supports, $r = .298$, $n = 64$, and $p = .017$. Therefore, the null hypothesis was rejected, and the alternative hypothesis was accepted.

An effect size of school leaders' engagement level and its impact on comprehensive schoolwide support systems using Cohen's *d* was determined by calculating the mean difference between the two groups, and then dividing the result by the pooled standard deviation. Cohen's $d = (3.56 - 2.5) / 1.74 = .61$ representing a large effect size (see Table 4.3).

Table 4.1

School Leaders' Engagement

Level	Weight	N
Low	0 or 1	24
High	2	40

Table 4.2

Pearson's Correlation between School Leaders' Engagement and Comprehensive Schoolwide Support Systems

		School Leaders' Engagement	Comprehensive Schoolwide Support Systems
School Leaders' Engagement	Pearson Correlation	1	.298*
	Sig. (2-tailed)		.017
	N	64	64
Comprehensive Schoolwide Support Systems	Pearson Correlation	.298*	1
	Sig. (2-tailed)	.017	
	N	64	64

**Correlation is significant at the 0.05 level (2-tailed).*

Table 4.3

Descriptive Statistics

Outcome Variable: Comprehensive Schoolwide Support Systems

School Leaders' Engagement	Mean	Std. Deviation	N
Low (0 or 1)	2.50	1.76	24
High (2)	3.56	1.63	40
Total	3.16	1.74	64

Research Question 2 Findings

RQ2. Is there an association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math?

$H_0$2: There is no association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math.

$H_1$2: Schools with a highly engaged school leader will have a higher level of program fidelity than schools without highly engaged leaders.

For this analysis, school leaders were categorized as having a low or a high level of engagement based on items one and seven from the schoolwide support section of the achievement snapshot items (see Table 4.4). As Table 4.1 illustrates, 24 school leaders were categorized as having a low level of engagement, and 40 school leaders were categorized as having a high level of engagement.

A Pearson's correlation was conducted to examine the association between school leaders' engagement and program fidelity (see Table 4.5). Table 4.5 suggests that there is a statistically significant interaction between school leaders' engagement and program fidelity, $r = .296$, $n = 64$, and $p = .018$. Therefore, the null hypothesis was rejected, and the alternative hypothesis was accepted.

An effect size of school leaders' engagement level and its impact on comprehensive schoolwide support systems using Cohen's *d* was determined by calculating the mean difference between the two groups, and then dividing the result by the pooled standard deviation. Cohen's $d = (6.56 - 4.74) / 2.99 = .61$ representing a large effect size (see Table 4.6).

Table 4.4

School Leader's Engagement Levels

Level	Weight	N
Low	0 or 1	24
High	2	40

Table 4.5

Pearson's Correlation between School Leaders' Engagement and Program Fidelity

		School Leaders' Engagement	Program Fidelity
School Leaders' Engagement	Pearson Correlation	1	.296*
	Sig. (2-tailed)		.018
	N	64	64
Program Fidelity	Pearson Correlation	.296*	1
	Sig. (2-tailed)	.018	
	N	64	64

**Correlation is significant at the 0.05 level (2-tailed).*

Table 4.6

Descriptive Statistics

Outcome Variable: Program Fidelity

School Leaders' Engagement	Mean	Std. Deviation	N
Low (0 or 1)	4.74	2.92	24
High (2)	6.56	2.86	40
Total	5.88	2.99	64

Research Question 3 Findings

RQ3: How prepared were the school leaders at the study schools to support the implementation of the PowerTeaching Math program?

Ninety percent of the original study school principals completed and returned the school principal survey. Descriptive statistics from were used to explore school leaders levels of preparedness for supporting the implementation of the PowerTeaching Math program.

Out of the total valid responses, 60% of school leaders said that they were "to a great extent" prepared to implement the program, followed by 35% who said they were "to some extent" prepared to implement the program. Four percent of school leaders said that “to a little extent” they were prepared to implement the program with 1% “not at all” prepared to implement the program.

Overall, 74% of school leaders reported that they were “to a great extent” prepared to (1) convey what the program was about to their teachers and school staff, (2) willing to prioritize implementation, given other pressing needs, (3) evaluate teachers on implementation of the program, and (4) provide effective instructional models for teachers to help support implementation of the program in the classroom. Of all the statements regarding preparedness, school leaders were the most divided by the extent to which they were prepared to budget for effective implementation. Of the total valid responses, 39% of leaders said that they were prepared “to a great extent,” 48% “to some extent,” 4% to “a little extent,” and 9% “not at all” prepared to budget for effective implementation. Tables 4.7 provides a breakdown of school leaders’ responses for each statement.

Table 4.7

Response Frequencies to Principal Survey Question 20 (Items A-P)

	Not at All		To a Little Extent		To Some Extent		To a Great Extent		Not Sure/Not Applicable		Total	
Question	n_i	%	n_i	%	n_i	%	n_i	%	n_i	%	N_i	Missing
To what extent were you prepared to convey what the program was about to your teachers and school staff?	–	–	1	4.3	5	21.7	17	73.9	–	–	23	4
To what extent were you prepared to influence teachers' motivation to implement the program?	–	–	–	–	8	34.8	15	65.2	–	–	23	4
To what extent were you prepared to clearly communicate to teachers the types of changes required by the implementation of the program?	–	–	–	–	10	43.5	13	56.5	–	–	23	4
To what extent were you prepared to prioritize implementation, given other pressing needs?	–	–	–	–	6	26.1	17	73.9	–	–	23	4
To what extent were you prepared to support individual change?	–	–	–	–	9	40.9	13	59.1	–	–	22	5
To what extent were you prepared to plan effective professional development to facilitate implementation?	–	–	1	4.3	9	39.1	13	56.5	–	–	23	4
To what extent were you prepared to provide effective instructional models for teachers to help support the implementation of the program in the classroom?	–	–	1	4.3	5	21.7	17	73.9	–	–	23	4
To what extent were you prepared to access practical how-to guidance to support the changes necessary to implement the program?	–	–	2	8.7	9	39.1	12	52.2	–	–	23	4
To what extent were you prepared to make high-quality professional development available to teachers?	–	–	1	4.3	5	21.7	17	73.9	–	–	23	4

Table 4.7 (continued)

Question	Not at All		To a Little Extent		To Some Extent		To a Great Extent		Not Sure/Not Applicable		Total	Missing
	n_i	%	n_i	%	n_i	%	n_i	%	n_i	%	N_i	
To what extent were you prepared to budget for effective implementation?	2	8.7	1	4.3	11	47.8	9	39.1	–	–	23	4
To what extent were you prepared to align the school's curriculum and instructional focus with the program?	–	–	1	4.5	7	31.8	14	63.6	–	–	22	5
To what extent were you prepared to evaluate teachers on the implementation of the program?	–	–	1	4.3	5	21.7	17	73.9	–	–	23	4
To what extent were you prepared to incorporate the program with new teacher evaluations or other state or national initiatives?	2	8.7	–	–	8	34.8	12	52.2	1	4.3	23	4
To what extent were you prepared to assure that standards-aligned programs are in place to positively affect students who struggle academically?	–	–	–	–	10	43.5	13	56.5	–	–	23	4
To what extent were you prepared to integrate the program with other programs that serve English language learners (ELLs), special education students, or students in other subgroups?	–	–	2	8.7	9	39.1	11	47.8	1	4.3	23	4
To what extent were you prepared to use expanded learning opportunities (e.g., extended day, after school) to support the program?	–	–	2	9.1	11	50	9	40.9	–	–	23	4

Research Question 4 Findings

RQ4: What steps did school leaders report taking at the study schools to implement PowerTeaching Math?

In addition to being prepared, effective school leaders are ones that "emphasize achievement, set instructional strategies, provide an orderly atmosphere, frequently evaluate student progress, coordinate instructional programs, and support teachers." (Sweeney, 1982). Response frequencies from the principal survey are used to explore the steps school leaders at the study schools took to implement the PowerTeaching Math program. Valid responses to question 21 of the school principal survey were used to identify the steps school leaders took at the study schools to implement the PowerTeaching Math program.

Of all the reported steps that school leaders took to implement the PowerTeaching Math program, 82% said that they gathered evidence through lesson plans, walkthroughs, and classroom observations to assess the effects of the Common Core (embedded within the program design) on teaching. Seventy-four percent of school leaders sent school math staff to professional development sessions on the program while 52% said that they modified their mathematics curriculum to align with the program or identified or purchased new textbooks and curricular materials that were aligned with the program (41%). Frequencies for all of the school leader responses are given in Table 4.8.

Table 4.8

Response Frequencies Outlining Steps Taken to Implement the Program

	N	Percent
Adjusted our school improvement priorities to accommodate standards-related activities.	16	59%
Created a leadership plan, objectives, and a timeline for implementation of the program.	17	63%
Gathered evidence through lesson plans, walkthroughs, and classroom observations to assess the effects of the Common Core on teaching.	22	82%
Modified our mathematics curriculum to align with the program.	14	52%
Identified or purchased new textbooks and curricular materials that were aligned with the program.	11	41%
Connected the program with expanded learning opportunities (e.g., extended day, after school, or summer programs) in your school.	14	52%
Used expanded learning opportunities (e.g., extended school day, after-school, or summer programs) to support implementation.	18	67%
Sent school math staff to professional development sessions on the program.	20	74%

Conclusion

The purpose of this chapter was to present the data analysis and findings related to the study research questions. This analysis sought to identify relationships between school leaders' engagement, schoolwide supports, and program fidelity to generate new findings associated with the PowerTeaching Math program elements not explored in the original program study. Statistical Package for Social Sciences (SPSS) was used by the researcher for testing the research questions. Pearson's correlations were used to identify the associations between program variables associated with RQ1 and RQ2 (r = .298 and r = .296). Cohen's d was used to determine an overall effect size of school leaders' engagement levels on (1) comprehensive schoolwide support systems, and (2) program fidelity (*d* = .61 and *d* = .61). The null hypothesis for RQ1 and RQ2 were rejected, and the alternative hypotheses were accepted due to significant relationships being identified between school leaders' engagement and comprehensive schoolwide support systems (p = .017), and between school leaders' engagement and program fidelity (p = .018). Descriptive statistics from the principal surveys were used to explore RQ3 and RQ4. Overall, 60% of school leaders said that they were "to a great extent" prepared to implement the program, with 84% reporting that they gathered evidence through lesson plans, walkthroughs, and classroom observations to assess the effects of the Common Core (embedded within the program design) on teaching. A summary of the research findings, implications for practice, and recommendations for future research are provided in Chapter 5.

Chapter 5 – Conclusions, Implications, and Recommendations

The purpose of this secondary data analysis was to explore PowerTeaching Math program elements not investigated in the MDRC study. For this study, a correlational explanatory design using archival program implementation and principal survey data was used to explore the relationships between school leaders' levels of engagement, comprehensive schoolwide support systems, and program fidelity to generate new findings associated with the PowerTeaching Math program to inform the program developers and to plan for additional program developments and supports. Data utilized for this analysis was clearly defined within the context of the original MSDE study. The data was limited and did not include all school achievement snapshot items developed and utilized to guide and support program implementation by the program developers, and the principal survey data was only available for the schools that participated in the three-year randomized controlled trial and not the scale-up study. For these reasons, the scope and focus for the secondary analysis was limited to program implementation, and no connection or association to student outcome data for each school could be made. This final chapter provides an interpretation of the findings for each research question and hypothesis, as well as implications and recommendations for future iterations of the program and future studies.

Summary of Findings

The objectives of this study were to (1) explore the link between school leadership and schoolwide supports., (2) explore the connection between school leadership and program fidelity, (3) understand how prepared school leaders felt to support program implementation, (4) identify the steps taken by school leaders to support the implementation of the PowerTeaching Math program. To meet these objectives, various statistical methods were used to answer the identified research questions. For RQ1 and RQ2, Pearson's *r* was used to determine the linear correlation between leaders' engagement and comprehensive schoolwide supports, and leaders' engagement and program fidelity. With appreciably two-thirds (63%) of the leaders in the analysis categorized as highly engaged, a *p*-value was used to accept or reject the null hypothesis for each question. Cohen's *d* was also used to determine the effect size of the associations between the two variable means under investigation. Descriptive and inferential statistics were used to answer RQ 3 and RQ4 as a means of providing descriptions of the school principals and making inferences and predictions based on a sample of data taken from the school principal survey (Table 5.1 provides a summary of the analysis findings). The main findings of the of the analysis are:

- There is a statistically significant and practical relationship between school leaders' engagement and comprehensive schoolwide supports.
- There is a statistically significant and practical relationship between school leaders' engagement and program fidelity.
- Approximately two-thirds of the school leaders in the study reported feeling prepared to implement PowerTeaching Math.
- Approximately two-thirds of the school leaders reported taking the given actions to support program implementation.

The results of the analysis highlight the importance of leader engagement in implementing and supporting whole school reform. In this study, schools with a highly engaged school leader had more robust levels of comprehensive schoolwide support systems than schools without highly engaged leaders. Similarly, this study indicates that schools with a highly engaged school leader had a higher level of program fidelity than schools without highly engaged leaders. In addition, this study indicates that when school leaders feel prepared, they are willing to take actions in support of program goals and objectives.

Table 5.1

Summary of Analysis

Question	Summary of Findings
1	n = 64 Pearson's r = .298 p-value = .017 Cohen's d = .61 Alternative hypothesis accepted
2	n = 64 Pearson's r = .296 p-value = .018 Cohen's d = .61 Alternative hypothesis accepted
3	90% response rate 60% of school leaders said that they were "to a great extent" prepared to implement the program, followed by 35% who said they were "to some extent" prepared to implement the program. 40% of school leaders said that "to a little extent" they were prepared to implement the program with 1% "not at all" prepared to implement the program.
4	Approximately 60% of school leaders reported taking the given actions to support program implementation.

Exploration of Findings

The literature in Chapter 2 suggested that there is a distinct relationship between leaders' engagement and organizational changes in schools that affect outcomes (Harris & Spillane, 2008). Leaders' engagement is an important factor in implementing and maintaining effective practices in schools. Consequently, the first research question (Is there an association between school leaders' engagement level and comprehensive schoolwide support systems in schools implementing PowerTeaching Math?) explored the relationship between school leader's levels of engagement and comprehensive schoolwide support systems. The finding of this study supports the relationship between engaged school leadership on both schoolwide systems and program fidelity. Because schoolwide supports and program fidelity are often associated with clearly articulating program innovation configurations and supporting teachers through the stages of concern and levels of use outlined by the CBAM (Hall & Hord, 2001, 2011), schools with a highly engaged school leader have more robust levels of comprehensive schoolwide support systems than schools without highly engaged leaders. As expected, the analysis found a statistically significant (p = .017) relationship between school leaders' level of engagement and a comprehensive schoolwide support system. Further, Cohen's effect size value (d = .61) suggested large practical significance.

An effective school leader can best be described as the keeper of the vision for the success of a program and the person most critical to program fidelity and success (Datnow &Castellano, 2001). A key element of maintaining the school's vision is to set high expectations for the performance of all teachers and students in the school. Keeping a clear and public agenda is the best way to ensure that a whole school reform or program is implemented effectively. When everyone in the building is clear that the principal expects a high-quality implementation and knows what that quality looks like, implementation fidelity soars (SFAF, 2015). Understanding implementation fidelity, or the "degree to which an intervention or program is delivered as intended" (Carrol, Patterson, Wood, Booth, Rick, & Balain, 2007, p. 1), is key to knowing how the difference in program implementation can affect the credibility and value of the research that the program is built upon (Carrol et al., 2007). With PowerTeaching Math, it is especially important for the system to address and support the changes in pedagogy and teacher attitudes and beliefs associated with the implementation of a cooperative learning-based intervention. The second research question (Is there an association between school leaders' engagement and program fidelity in schools implementing PowerTeaching Math?) explored the relationship between school leaders' engagement level and program fidelity. The analysis found a statistically significant relationship between school leaders' level of engagement and program fidelity (p = .018), illustrating that schools with highly engaged school leaders will often have a higher level of program fidelity than schools without highly engaged leaders (d = .63).

When school leaders are prepared, they can influence the success and quality of school outcomes through the alignment of school structures with the school's vision and mission (Hallinger & Heck, 1996a, 1996b). Leaders who develop a shared vision, build consensus about school goals, provide individualized support to teachers, and convey high expectations, have a more productive school culture to weather the stages of change (Leithwood, Jantzi, & Steinbach, 1999; Tuckman, 1965). Results of the school principal survey indicated that 95% of school leaders felt that they were at least to some extent prepared to implement the PowerTeaching Math program. Approximately, three-quarters of the leaders surveyed reported that they felt prepared to convey what the program was about to their teachers and school staff and that they were willing to prioritize program implementation, given other pressing needs. In addition, the majority of principals (74%) felt that they were prepared to evaluate teachers on their implementation of the program and to provide effective instructional models for teachers to help support their implementation of the program in the classroom. School leaders were the most divided by the extent to which they were prepared to budget for effective implementation. Less than 40% of the school principals were prepared to budget for effective implementation after at least two years of program implementation.

The literature on school reform suggests that successful program implementation is based on (1) a school's instructional capacity, and (2) a school leader's ability to cultivate a school's instructional capacity (Spillane & Louis, 2002). Of the school principals surveyed, the vast majority (approximately 96%) said that they were at least to some extent prepared to make high-quality professional development available to teachers, and to plan effective professional development to facilitate implementation and support individual change. Also, all school leaders were at least to some extent prepared to align the school's curriculum and instructional focus with the program and assure that standards-aligned programs were in place to positively affect students who struggle academically. Most school principals (87%) were to some extent prepared to integrate the program with programs that serve English language learners (ELLs), special education students, or students in other subgroups. Overall, school principals felt prepared to support individual change (100%) and prepared to influence teachers' motivation to implement the program (65%).

In addition to being prepared, effective school leaders are ones that "emphasize achievement, set instructional strategies, provide an orderly atmosphere, frequently evaluate student progress, coordinate instructional programs, and support teachers." (Sweeney, 1982, p. 350). To identify the steps school leaders reported taking at the study schools implementing the PowerTeaching Math program identified in the last research question (What steps did school leaders report taking at the study schools to implement PowerTeaching Math?), additional responses from the principal survey were used. Of all the reported steps that school leaders took to implement the PowerTeaching Math program, the majority (82%) said that they gathered evidence through lesson plans, walkthroughs, and classroom observations to assess the effects of the Common Core (embedded within the program design) on teaching. Seventy-four percent of school leaders sent school math staff to professional development sessions on the program while 52% said that they modified their mathematics curriculum to align with the program or identified or purchased new textbooks and curricular materials that were aligned with the program (41%).

An essential component to the success of school reform and program implementation is a school leader's ability to work with teachers. As stated previously, a leader who takes the time to develop a shared vision, build consensus about school goals, provide individualized support to teachers, and convey high expectations, has a more productive school culture to weather the stages of change (Leithwood, Jantzi, & Steinbach, 1999; Tuckman, 1965). Leveraging distributed leadership and establishing schoolwide supports helps empower teachers through collaboration, giving them not only a support network in which failure is not an option but, also giving teachers a voice in decisions that have a schoolwide impact (Smylie & Hart, 1999; Spillane & Louis, 2002). With that in mind, over half of the school principals surveyed reported that they adjusted their school improvement priorities to accommodate standards-related activities (59%), and created a leadership plan, objectives, and a timeline for the implementation of the program (63%). Connections between the program and expanded learning opportunities (e.g., extended day, after school, or summer programs) were made (52%) and expanded learning opportunities (e.g., extended school day, after-school, or summer programs) were used to support the implementation of PowerTeaching (67%).

To varying degrees, the responses used to explore the steps taken by school principals, and how prepared they felt to implement the program, echo the findings of studies and theories in this area (Fullan & Hargreaves, 1996; Leithwood, 1994; Leithwood et al., 1998; Leithwood & Riehl, 2003). There is a clear connection between a school leader's levels of preparedness and actions. This connection can influence a school principal's ability to create an environment that supports program implementation fidelity. Empowering teachers through a distributed leadership approach helps to establish a comprehensive schoolwide support system that aligns all parts of a school and fosters continuous improvement and learning (Leithwood, Jantzi, & Steinbach, 1998; Spillane, Halverson, & Diamond, 2001).

Implications of Findings

A correlational exploratory research design using archival data was used to determine if a relationship exists among PowerTeaching Math program variables. This approach allowed for a systematic investigation into the nature of these relationships. Building on existing knowledge and literature, this non-experimental approach provided the means for hypotheses testing so that predictions about behaviors could be made. The results of this secondary analysis can have implications for possible social change and should be considered by program developers when designing or modifying program supports at the individual, organizational, and societal levels in order to better develop relationships among the program variables explored in this study.

Individual and Organizational Implications

PowerTeaching Math is a key strategy of SFAF, a non-profit education reform organization that develops and disseminates programs based on a continuous improvement model designed by JHU's Center for Research and Reform in Education. SFAF's influence is achieved by addressing a combination of political systems and organizational theories at the state and local levels. Results from this study suggest that a deeper understanding of the relationships among stakeholders within the school system is needed to gain the support necessary for research, development, and program adoption and implementation (see Zeehandelaar, 2012). By understanding stakeholder relationships within schools and exploring their needs (at the individual and interest group levels), bridges can form to help align PowerTeaching Math and other resources to state and national educational policies. This level of understanding can be further explored through rational choice theory (RCT) regarding how individuals within the school system maximize their advantage or gain and minimize their disadvantage or loss (see Boyd, Crowson, & van Geel, 1994).

Individual and Organizational Recommendations. With "the mounting calls for 'systemic reform' and the 'reinvention' of American education being heard even inside schools of education… school faculty are increasingly open to serious discussions about [the] fundamental restructuring of schools" (Boyd, Crowson, & van Geel, 1994, p. 143). Further exploration of the relationships between school leaders' level of engagement, comprehensive schoolwide support systems, and program fidelity will allow for an organizational view to be applied for whole school impact to be studied. Additional research into the systems of power between stakeholders is key to designing additional supports that affect the entire system (as is the case with program adoption). PowerTeaching's current approach is not intended to establish a power play or "zero-sum game in which one person's gain is another's loss" (Boyd, Crowson, & van Geel, 1994, p. 133). Instead, it is to establish a culture of mutual advantage in which the system at large is successful in meeting the needs of the students it serves. Studying this dynamic further can help inform future iterations of the program.

Results of this study highlight the importance of principal engagement and can be used to help illustrate to state and local school systems how PowerTeaching Math structures can be used to support a whole school approach. Results also reinforce the notion that leadership helps to influence subsystems within a school, and through varying degrees of engagement help these subsystems to work together "to redesign the instructional core of public education to meet the human and social capital needs of the new society" (Weeres & Kerchner, 1995, p. 139).

Implications and Recommendations for Program Developers

With the statistical and practical findings indicating a clear correlation between leaders' engagement levels and schoolwide systems of support, program developers should develop additional strategies to engage school leaders as a way to increase program fidelity. Examining existing program elements (e.g., leadership training and how-to-guides) and how they align with the CBAM (see Hall & Hord, 2011) and stages of change (see Tuckman, 1965) could help make modifications or additions to program offerings that could strengthen and promote leadership engagement.

Considering a technical assistance (TA) approach is another way PowerTeaching Math could be refined to increase program fidelity. Like many of the current program elements of PowerTeaching Math, TA is the process of providing schools with targeted support to address a given problem (Turnbull, White, Sinclair, Riley, & Pistorino, 2011). An effective TA model should include a multi-tiered system of support (Sugai & Horner, 2009) that utilizes coaching, a data-informed decision-making process, and professional learning communities to provide a systems-approach to support a shared vision and mission (Kratochwill, Volpiansky, Clements, & Ball, 2007). However, lessons learned, from the randomized controlled trial, scale-up and subsequent secondary analysis of PowerTeaching Math concerning leaders' engagement, comprehensive schoolwide supports, and program fidelity should be addressed.

Unlike the current iteration of PowerTeaching Math, TA could occur in a face-to-face setting or virtually using a web-based coaching and support system. Despite the different coaching approaches utilized, coaching is seen as a powerful form of professional development that can support the growth of teachers and administrators as they work to meet the needs of their students (Killion, 2016a). Although there have been many successes that can be attributed to effective coaching, its impact on teachers' self-efficacy is unclear. Literature indicates that teachers' self-efficacy increases with time and teaching experience, limiting the correlation between coaching and teachers' self-efficacy (Fortman & Pontius, 2000; Woolfolk Hoy & Burke-Spero, 2005). The time and cost associated with coaching limit its long-term impact and sustainability within schools (Beltman, 2009; Edward & Green, 1999) and coaches often spend more than half of their time tending to other issues unrelated to coaching (e.g. testing, teaching students, and managing materials) (Campbell & Malkus, 2011). With the increase in technology development, providing distance coaching could be used to increase the level and frequency of support provided by SFAF. Increasing the frequency of support through a virtual means could help address specific implementation concerns in real-time as teachers' progress through the change process (Hall & Hord, 2001; Tuckman, 1965). This additional level of support could have a positive impact on leadership development and teacher efficacy leading to systems change occurring within a shorter timeframe, while building internal capacity, and reducing the need and cost associated with traditional face-to-face support (Ghaith, Glover, & DiPerna, 2007; Hamilton et al., 2013).

By critically analyzing existing PowerTeaching Math supports and re-designing them to place additional emphasis on increasing leaders' engagement, schools could benefit from an additional emphasis placed on program implementation, systems alignment, and student performance goals (Balfanz, Legters, West, & Weber, 2007). When teachers and administrators work together to establish implementation goals and use data tracking tools to support program fidelity, they have a better understanding of how to make connections to program use to support student learning (Wayman, Cho, & Richards, 2010). With the advancements in data systems and with technology readily available to teachers and administrators, a redesign of the PowerTeaching Math integrated data system could provide all the student data needed to make effective decisions (Wayman & Stringfield, 2006) that could be discussed in a more targeted Professional Learning Community (PLC) with a focus on program implementation and fidelity. There has been limited research on using a more TA type approach and its impact on student achievement (Figlio & Loeb, 2011; Gottfried, Cross, Hoover, &

Stecher, 2011). Therefore, replicable TA models are scarce and extensive research and development would need to be conducted by SFAF and third-party evaluators to assess its impact on PowerTeaching Math outcomes.

Implications for Society

Within the educational world, there is a growing need for educational practice and policy to be based on evidence from rigorous experiments to ensure that "diverse racial, ethnic, and social-class groups will experience educational equality." (Banks, 2016, p. 30). Federal recommendations that promote the use of proven and comprehensive programs like PowerTeaching Math (see the Reading Excellence Act, 1998; and No Child Left Behind Act, 2002), however, have resulted in little impact on practice and student outcomes (Slavin, 2016). The lack of program impact can be attributed to the apparent disconnect between federal, state, district, school, and teacher interpretations of policy that result in a lack of clarity for supporting the educational advancement of all students (Bartell, 2001). Because of educational policies, educators are expected to implement research-proven programs like PowerTeaching Math to raise student achievement. Without appropriate training and support, however, a lack of program fidelity often leads teachers to believe that a program is ineffective before it has had a chance to be successful. With the ever-increasing diversity within the United States, there is a need to amend these policies to ensure that all students benefit from educational equality so that they can "function effectively within their cultural, national, regional, and world communities" (Banks, 2016, p. 28).

With the reauthorization of the Every Student Succeeds Act (ESSA) (S. 1117, 2015), a significant shift towards the use of proven programs within schools is underway.

ESSA not only defines standards of evidence-based programs but also promotes the use of programs and practices within schools that meet these standards (S. 1117, 2015). These standards, however, only require single studies to determine program effectiveness. Program recommendations are classified as strong, moderate, or promising, allowing schools to judge effectiveness before adoption and implementation. Unlike PowerTeaching Math, which has undergone 14 evaluations of the PowerTeaching Math strategy (including studies using the previous name, Student-Teams Achievement-Divisions) in either elementary or secondary schools (see Nunnery, Chappell, & Arnold, 2013), current ESSA standards for program effectiveness allow the use of measures developed by researchers and developers that have a stake in the success of the program under review. In addition, the ESSA evidence classifications do not adequately represent the buy-in, planning, and supports (i.e., professional development, use of formative and summative data) necessary for program success that are often funded by federal Title 1 funds. Without these supports, there is evidence that suggests a limited return on investment in relation to student achievement, especially for minority students (Birks, Snook, Prochnow, Rawlins, & O'Neil, 2013).

Societal Recommendations. Although ESSA promotes the use of programs like PowerTeaching Math, there are two recommendations for the current legislation to help strengthen schools' adoption and implementation of programs that have evidence of meeting the needs of all students.

The first recommendation is to expand and clearly define the ESSA standards used to determine program classification (i.e., strong, moderate, or promising). Increasing the research criteria to two or more studies to validate program effectiveness would allow for additional layers of substantiation across multiple settings. By providing federal guidance at each classification level, the strengths and limitations of various study designs could help support the use of randomized control trials in educational research to provide the strongest empirical evidence of a treatment's efficacy (Creswell & Plano Clark, 2013).

The second recommendation is to set clear expectations for the use of Title I, II, III, and IV funding to support the learning and development of teachers and administrators as they adopt research-based programs. Clearly defining the use of federal funds for coaching, support, training, and mentoring, all grouped under the federal term Technical Assistance (TA), can help better position schools to put policy into practice as they adopt a whole school reform model. The primary rationale of TA is to help schools align all parts of a school in relation to federal policies and practice (e.g., organizational structures, vision and mission, instructional teams, and processes, etc.) which in turn will substantially increase the power of an intervention's effectiveness in relation to student outcomes (Anthony, Gimbert, Fultz, & Parker, 2011; Rodriguez, 2013).

Implications for Future Research

Adding to a growing body of literature that explores evidence-based research and reform in education, this study provides additional evidence regarding school leaders' levels of engagement and it's relationship to comprehensive schoolwide support systems and program fidelity. The results of this study, though not unexpected, support the importance of a leader in implementing a whole school reform model rooted in cooperative learning (Antil, Jenkins, Wayne, & Vadasy, 1998; Hennessey & Dionigi, 2013; Murphy et al., 2001; Pechman & Fiester, 1994; Slavin, 2008a, 2008b). As Slavin suggests, however, "perhaps the most important requirement for evidence-based reform is the development of a substantial set of replicable programs and practices with strong evidence of effectiveness." (Slavin, 2008b, p. 154). With this in mind, additional empirical studies of future iterations of PowerTeaching Math, aligned with the What Works Clearinghouse standards established under the Education Sciences Reform Act of 2002, should be conducted to continue to evaluate the program and its impact on schools, leaders, teachers, and students.

Research Recommendations. There are many known and unknown reasons why whole school reform models like PowerTeaching Math do or do not achieve their desired outcomes. Previous research conducted on whole school reform models, especially those that are grounded in cooperative learning (e.g., Success for All), tend to explore certain parts of the model but neglect to explore the impact that these parts have when they do not work together toward a common goal centered on student achievement. Future research could benefit from the use of a longitudinal study that explores the factors that influence teachers' implementation of a cooperative learning-based intervention. Using measures like the cooperative learning implementation questionnaire (see Abrami, Poulsen, & Chambers, 2004) could help program developers build upon the results of this study by investigating what factors could be supported by leaders and schoolwide supports to increase program fidelity. By identifying factors associated with teachers' view on cooperative learning and existing teaching practices, developers could create or adapt program supports that address the stages of change and concern by expanding innovation configurations that support the levels of program use over multiple years (see Tuckman, 1965 and Hall & Hord, 1991). Confirmatory or causal studies could also be conducted to test priori hypotheses associated with individual program components that support program implementation (e.g., coaching and its impact on changing teacher efficacy). Results from such a study could potentially be used by schools to help justify the need for additional personnel at the school level, while findings from an explanatory study focusing on teacher roles and program fidelity could be used to help justify why distributed leadership and networks of support (e.g., PLCs) should be in place to enhance program fidelity. Regardless of any future studies of PowerTeaching Math, a commitment to research and program development by the developers have been made to contribute to the need for evidence-based practices in education.

Study Conclusion

Because evidence-based interventions often have variable effects in the real world, investigating factors that support implementation is an important step in making sure that any future iterations of the program in question have the necessary supports so that the system works synchronously to ensure student achievement outcomes are met. With its whole school approach, PowerTeaching Math is a comprehensive schoolwide program monitored and supported by researchers, coaches, school leaders, and teachers. Understanding the relationship at the school level between leaders, schoolwide support systems, and program fidelity is an essential element of program design and enhancements. Findings from the MDRC study regarding teachers' consistent use of the program to transform group work into cooperative learning led to an exploration of the study data using a three-step approach for conducting a secondary analysis "that begins with the development of the research questions, then the identification of the dataset, and thorough evaluation of the dataset" (Johnston, 2013, p. 620).

Schools that effectively implement interventions like PowerTeaching Math tap into the synergy of this systems approach to ensure that the interrelationships are mutual, beneficial, and focused on optimal learning (Morrison, Ross, & Kemp, 2004; Zhao & Frank, 2003). It was important to understand that the impact of change within a school is key to implementing a program with fidelity and achieving the desired outcome of an intervention (Tuckman, 1965, Hall & Hord, 2001). Without strong and engaged leadership, the literature suggests that schools may struggle to implement a new program or intervention as there is no support for teachers as they navigate through the change process (House & Aditya, 1997; Setters & Field, 1990). Distributed leadership, however, can build greater ownership throughout the school community and can offer a more realistic approach to implementing a program with fidelity (Bennett, Wise, Woods, & Harvey, 2003). Professional development is also an essential element of program implementation and can have an impact on program fidelity (Borko, 2004; Guskey & Huberman, 1995; Killion, 2008). When schools implement professional development strategically and align it with program design and school goals, teachers have a higher frequency of program implementation and fidelity (Darling-Hammond et al., 2007; Killion, 2008). Additional supports such as Professional Learning Communities have a broad impact on teacher development, school culture, program fidelity, and student achievement outcomes (Andrews & Lewis, 2007; DuFour, 2004; Hord, 2004; King & Newmann, 2001; Senge, 1990; Westheimer, 1999).

Knowing from literature that the combination of program resources, teacher supports, and school leadership impact the quality of program fidelity (Bryk & Gomez, 2015; Glazer, Hannafin, & Song, 2005; Yendol-Hoppey & Dana, 2010), the secondary analysis confirmed that schools with a highly engaged school leader tend to have higher levels of program fidelity than schools without a highly engaged leader. Also, schools with a highly engaged school leader have a more robust level of comprehensive schoolwide support systems than schools without a highly engaged leader. When prepared, leaders are willing to take the steps needed to align their school's vision and mission to program goals and to support program implementation.

There are several important points to consider when interpreting the study results. As CBAM (see Hall & Hord, 2011) describes, change happens in stages, and even though the schools included in the analysis had implemented the program for two years, there could have been some confounding variables (e.g., teacher attrition and leadership changes) that were not explored or taken into account in this analysis. These confounding variables could help explain the fact that only two-thirds of the schools had highly engaged leaders.

It is assumed that the highly engaged leaders identified in the analysis worked to ensure that each stage of change (see Hall & Hord, 2011) was supported. However, an engaged leader does not necessarily mean that the comprehensive schoolwide systems were of the quality needed to ensure that real sustained program implementation and success occurred. Without implementation quality driving the alignment of the comprehensive schoolwide systems, student achievement effects may not be as strong. Program implementation must be done with fidelity and quality for programs to be successful and for student achievement outcomes to be met (O'Donnell, 2008). Moving towards a more sophisticated and refined implementation means using the structure of the program while adjusting instruction to meet the needs of individual students. It is the difference between doing a program and using a program that results in real success (SFAF, 2015). With only about two-thirds of the schools in the analysis having a highly engaged leader, the implications for implementation quality and student achievement outcomes need to be explored.

As evidenced by the self-reported steps taken by school leaders to implement PowerTeaching Math, engaged leaders often use an implementation plan to establish formal and informal coaching mechanisms for their teachers and school staff. This plan not only helps with the initial implementation of PowerTeaching Math but also recognizes the different needs that teachers may have depending on their level of use and comfort in implementing the program. Engaged leaders know that during the different stages of change (see Hall & Hord, 2011), educators experience a variety of concerns. By understanding and planning for the different stages of concern (see Hall and Hord, 2011), engaged leaders provide appropriate levels of support to help address the change process. For example, teachers who are new to PowerTeaching tend to be concerned with issues such as materials and lesson pacing. Experienced PowerTeaching teachers are generally more concerned with the impact of their instruction on student achievement.

Progressing through each stage of concern (i.e., self, task, and impact) is a normal part of any new endeavor (Hall & Hord, 2011). Throughout the early days of the program implementation, engaged school leaders listen to, support, and reassure teachers and staff that fundamental issues are being addressed. With sufficient support, most teachers can move on and focus on program implementation. Once a new program begins, a flurry of new activities commences. Within PowerTeaching Math, teachers are trying to follow the schedule, learn how to transition students, introduce new activities, and master new record-keeping systems. Setting up systems to effectively handle the tasks of PowerTeaching implementation is essential for a high-quality program (SFAF, 2015).

Engaged leaders also assist teachers and teams with the change process. Setting up systems to achieve a smoothly functioning program, however, is not enough. Engaged leaders also help teachers reflect on the impact of what they do to implement the program with fidelity. The big danger point in a new implementation of PowerTeaching Math is the storming stage (see Tuckman, 1965) that coincides with mechanical use (see Hall & Hord, 2011) of the program. This is the time when teachers are most concerned about issues of self and task. For staff members who have felt success with their old methods of teaching, feeling awkward can be very uncomfortable. Effective leaders know that a drop in morale and an increase in negativity is to be expected, and take the necessary steps to helps staff through their discomfort, with a focus on maintaining program integrity, and supporting school personnel to routine levels of implementation (SFAF, 2015).

Based on the self-reported levels of preparedness and the self-identified steps taken to support the implementation of the program, it is assumed that engaged leaders were probably taking some of the recommended steps in their schools that could have resulted in stronger school supports and therefore program fidelity. These program recommendations include:

- **Clearing the decks**: School leaders must make it as easy as possible for people to concentrate on what they need to learn and practice. If there are too many competing priorities, the teachers will either become overwhelmed or use those competing priorities to avoid implementing PowerTeaching Math. Keep life simple for the staff as they begin a major new initiative. Whatever can be put on hold or supported in other ways should be. Keep the decks clear enough for the staff to have the time and energy to acquire new skills.

- **Allocating adequate resources**: New initiatives cannot be implemented without dedicated resources and supports. Making sure that teachers have the resources that they need to be effective is crucial. During implementation planning, leaders should review the resources necessary for program success, and build those in from the beginning.
- **Setting time aside**: Teachers need time to learn new strategies, time to discuss new practices, and time to self-assess their early progress. School leaders need to set aside time to be with teachers, feel the pulse of the school community, and do frequent classroom observations. Setting aside time both for the leadership team and for teachers is essential to program success. Schedule time to do classroom observations and attend staff meetings. Effective leaders keep their time in the classroom inviolate. Schedule release time to meet new program needs. Time is a school leader's ally if used intentionally.
- **Keeping it simple:** Implement PowerTeaching in stages. When asked to implement a new program, many teachers cannot put everything together all at once. That is the definition of the mechanical stage. Teachers can feel awkward, and their implementation is piecemeal. An engaged leader can help by setting parsed expectations. Some teachers may need to put pieces of the program in place sequentially. Make a clear, supportive timeline of how to initiate each program piece if necessary. Be clear about what needs to be in place by the end of week 1, week 2, etc.

- **Scheduling review opportunities**: Many teachers may need to hear or see something more than once before they can do it. Be sure to allow enough time for teachers to observe one another, watch program videos, and have question-and-answer sessions with program providers.
- **Predicting the dip**: If teachers are aware that an implementation dip is part of a new implementation, it helps to normalize the process (see Tuckman, 1965). Leaders need to emphasize that the frustrations of early implementation are a universal part of the change process and not evidence of failure.
- **Conducting thumbs-up classroom observations**: During the mechanical phase, teachers need a great deal of encouragement. Leadership needs to be supportive and present. Frequent classroom observations that only look for successes can be a booster.
- **Having focused talk time**: Teachers may need to talk; however, be careful about venting. Venting is useful if it leads to problem-solving. Venting to vent merely supports negativity. A leader needs to be supportive but should move conversations toward solutions. Sometimes teachers have legitimate concerns that need to be solved. Problems with materials, staffing, and scheduling are all common in the early stages of program implementation. These are important issues, and the sooner action is taken, the more supported and optimistic teachers will feel. General discontent as a result of the change is also common. In this case, leaders should listen but reassure teachers that this too will pass. Point out exceptions to problems and small successes as evidence that a calmer, easier, and more successful day is coming. Listen and empathize, but help teachers move

forward. Describing their frustrations as part of the implementation dip and convey empathy and a sense of hope. Such an approach will normalize teachers' experiences and remind them that the implementation dip does not last forever.

- **Maintaining the vision**: As hard as the early stages of change may be, teachers need to remember why it was necessary and what the school hopes to accomplish. The good old days were not so good, and the bad old present is only temporary. A better day is coming, and using research-proven practices should lend confidence to everyone that once they have mastered these new practices, better things will happen for the students.
- **Celebrating small successes a lot**: Celebration is the key to success. There are many ways to celebrate small successes with teachers. Leaders should be creative and think about small, frequent ways to mark success and show appreciation. Acknowledging everyone's efforts is one of the best ways to build a sense of team and lessen the length of the implementation dip.
- **Providing ample time for coaching**: The instructional coach needs to spend most of their time supporting and coaching teachers. Without this kind of ongoing support, the implementation dip can become a trench. Guarding an instructional coach's time for coaching and make sure that a formal coaching plan is in place for staff should be a priority (SFAF, 2015, p. 159-160).

The findings of this secondary analysis should be used in conjunction with the MDRC study findings to make program modifications, and enhancements focused on program elements that increase leaders' engagement and strengthen existing schoolwide supports that ultimately increase program fidelity in all schools implementing the program. Any future iteration of PowerTeaching Math should continue to be researched so that elements of the program design and their impact on schoolwide and student achievement can be assessed fulfilling SFAF's "social commitment to see that children succeed whatever their social backgrounds" (Slavin, 2005).

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Appendix A

Group Work Is Not Cooperative Learning:
An Evaluation of PowerTeaching in Middle Schools

Group Work Is Not Cooperative Learning: An Evaluation of PowerTeaching in Middle Schools

A Report from the Investing in Innovation (i3) Evaluation

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June 2017

mdrc
BUILDING KNOWLEDGE TO IMPROVE SOCIAL POLICY

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Overview

In the next decade, the fastest growing occupations are projected to be in the fields of science, technology, engineering, and mathematics, and will require advanced mathematical and scientific knowledge. Unfortunately, many American students today, especially those in low-income schools, are performing at low levels in math and will have trouble gaining access to these jobs. It is therefore critical that middle school students succeed in math. The PowerTeaching program is a middle school math program that has shown strong evidence of effectiveness. Developed by the Success for All Foundation, it emphasizes cooperative learning to instruct math. In 2011, Old Dominion University received a grant through the U.S. Department of Education's Investing in Innovation program to scale up the PowerTeaching program. In 2012, MDRC began a multiyear evaluation of the scale-up effort, conducting an implementation study and an impact study that included a school-level randomized controlled trial. Over two years, the research team randomly assigned 58 schools, of which 30 (those assigned to the program groups) were part of the scale-up effort. The remaining 28 schools were assigned to the control group and as such were not part of the scale-up group of schools. This report describes the evaluation and presents its findings, key among which are the following:

- Although the Success for All Foundation and the schools in the study provided the requisite time, staff, and materials needed to support teachers in their implementation of the PowerTeaching program, teachers in only a few schools collected and used student assessment data to drive instruction, and most teachers did not receive the kind of training and support needed to create cooperative learning teams in their classrooms.
- Students in both program and control group schools worked in groups often, but students in program group schools spent more time in groups than students in control group schools. Students in program group schools were also more likely to be in longstanding mixed-ability groups. Despite these differences found in group work, many teachers in program group schools did not use the techniques that move group work to true cooperative learning.
- Students in both the program group and control group schools performed equally well on math, as measured by their state math test scores. However, students in schools that enrolled in the study earlier did worse than those students in schools that enrolled later.
- While, overall, implementation of the program was weak in all the schools participating in the evaluation, the non-research scale-up schools — which tended to be smaller and in less urban environments — implemented the PowerTeaching program slightly better than the schools in the study.

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Preface

To succeed in today's economy, students need both proficiency in the "three Rs" and strong applied skills. Communication skills, team work, and critical thinking have long been at the top of employers' lists of applied skills they seek in employees. States are responding to employers' needs by putting in place new educational standards. These standards include not only higher levels of basic academic knowledge that students are expected to master but also applied skills pertaining to presenting information, explaining one's reasoning, and effectively collaborating in groups. As a result, teachers nationwide are having students work in groups more frequently. This report examines a recent large-scale effort to expand a cooperative learning program in middle schools.

The change in standard instructional practices gives schools a chance to not only teach students applied skills, but improve students' academic learning, if they can help teachers turn "group work" into "cooperative learning teams." PowerTeaching, a structured cooperative learning program, was designed to do just that. Thus, the expansion of PowerTeaching through a federal Investing in Innovation grant offers the education field a unique opportunity to learn what it takes to help teachers create cooperative learning environments in their classrooms.

This report presents the lessons learned from this scale-up effort and findings from a multiyear evaluation of it. It describes how PowerTeaching was implemented over the first few years, how classrooms with the program differed from those without it, and whether students in the program performed better in math. The evaluation found that while teachers who taught with PowerTeaching learned to place their students into longstanding mixed-ability groups, which are thought to be conducive to cooperative learning, teachers did not consistently use the program's instructional techniques that transform group work into cooperative learning. In turn, students' math performance did not differ significantly between schools using the program and schools not using it. A likely cause for the weak implementation was that the ongoing professional development, which is an integral part of the PowerTeaching program, mostly did not occur or focused more on teaching the new material required by recently adopted education standards rather than on cooperative learning techniques. The evaluation thus points to the importance of focused, ongoing training and support when trying to modify teachers' instructional practices.

Gordon L. Berlin
President, MDRC

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The evaluation of the Investing in Innovation (i3) scale-up initiative of Success for All's middle school PowerTeaching program, and this resulting report, reflects the efforts of many people. Our first debt of gratitude is to the principals, Success For All Foundation (SFAF) coaches, research liaisons, PowerTeaching facilitators, and teachers at the schools that participated in the study; to staff members in the central offices of the five school districts who provided us with critical student records data as well as staffing information; and to district coaches who took part in the interviews. The assistance and cooperation of these individuals were vital for enabling the study to go forward and for providing the rich and detailed information on which this report is based.

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Fred Doolittle ensured that the team received both material and moral support at every turn. He, along with Janet Quint, Marie-Andree Somers, Robert Ivry, and Jennie Kaufman carefully reviewed earlier drafts of this report and made comments that improved the final product. Mario Flecha handled a variety of administrative and other tasks. Kelly Granito and Alpesh Shah provided fiscal oversight. Christopher Boland edited the report, and Carolyn Thomas prepared it for publication.

The Authors

Introduction

Ensuring students are on target in math is critical for at least two reasons. First, the fastest growing occupations in the next decade are projected to be in the science, technology, engineering, and mathematics (STEM) fields and require advanced mathematical and scientific knowledge.[1] Second, math skills act as a filter for better career outcomes since many higher-paying careers (even those that do not require math) require that a student has completed high school or college math prerequisites.[2] Research shows that achievement in math at the start of high school has a significant effect on students' career aspirations and the courses they choose to take.[3] Unfortunately, many American students today are performing at low levels in math — especially those in high-need middle schools where eighth-graders on average consistently test below proficiency — and will have trouble gaining access to these jobs.[4]

To address the underperformance in math of students in high-need middle schools, in 2011, the U.S. Department of Education awarded a five-year Investment in Innovation (i3) grant to Old Dominion University, Johns Hopkins University, and Success for All Foundation (SFAF) to scale up and further test PowerTeaching — a middle-school cooperative learning math program that has shown strong evidence of effectiveness.[5] This report presents findings from a multiyear evaluation of this i3 scale-up effort.

PowerTeaching

SFAF developed the PowerTeaching model used in the i3 scale-up (PTi3 for short) based on over 25 years of extensive research and refinement of the model. Its components are intended to provide teachers with the necessary tools to incorporate cooperative learning strategies into their instructional practices.[6] It can be implemented within any school's or district's existing curriculum since it focuses on instructional practices rather than specific math material.

[1] Hanushek, Peterson, and Woessmann (2010).

[2] Sherman (1982).

[3] Shapka et al. (2006).

[4] The Nation's Report Card (2017).

[5] PowerTeaching was formerly known as Student Teams-Achievement Division. There have been 14 evaluations of this strategy in either primary or secondary schools (Nunnery and Chappell, 2011). The average impact on math test scores was a positive shift of 0.60 of a standard deviation for secondary school students and a 0.13 standard deviation shift for primary school students. The average impact of the studies that met the evidence standards of the What Works Clearinghouse was 0.42.

[6] Cooperative learning, as will be discussed in detail in this report, is different than group learning. In cooperative learning, students work as a team, holding each other accountable for the learning of the group as opposed to group learning where students work together or in close proximity but ultimately are only responsible for their own individual learning.

Figure 1 presents the logic model for PowerTeaching. SFAF recruits school districts that are interested in adopting this approach to math instruction. The leadership in a middle school that will receive PTi3 must commit to supporting the program for three years and the school must provide a part-time math facilitator for each school. SFAF provides training to the principal, facilitator, and math teachers before the school year starts and ongoing training to the math facilitators who in turn train the math teachers in the PTi3 schools. Because mastery of cooperative learning takes time, teachers are expected to participate in continuous improvement meetings, specifically biweekly PTi3 professional development sessions ("component team meetings") led by the facilitator. The meetings are intended to help teachers set PTi3-specific instructional goals, monitor teachers' implementation of the program, discuss classroom challenges, and review student progress. Data showing teacher and student progress are shared and discussed.

If the training and ongoing support are adequately delivered, teachers will be able to incorporate PTi3's instructional strategies into their math classes. In particular, they would place students in longstanding heterogeneous skill groups and provide them with structured opportunities to practice the three key elements of cooperative learning teams:[7]

- Team recognition — students embrace team identity and care about the team's performance
- Equal opportunities for all students to help the team — all team members, no matter their ability, can contribute to the team goals by improving on their past performance
- Team interdependence — team success depends on each individual's learning, while an individual's grade depends only on his or her own performance

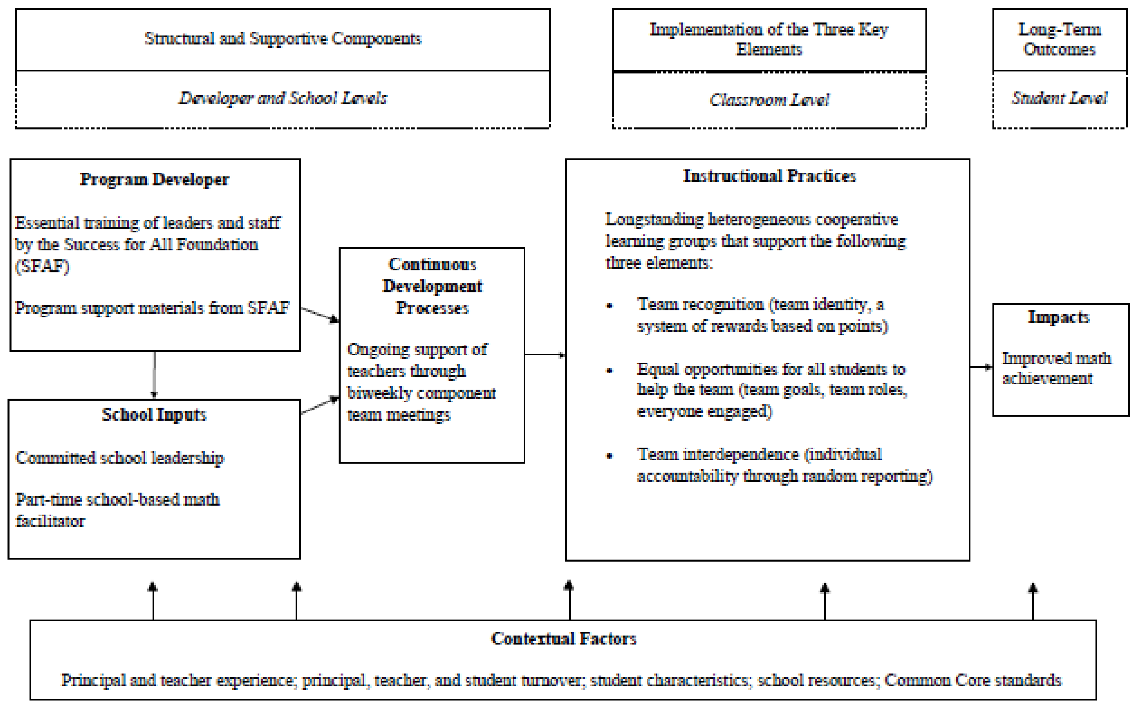
The PTi3 model posits that this team structure coupled with the use of specific cooperative learning strategies creates an environment in which students help each other learn the material and hold each other accountable for both their learning and behavior.

In order for students to feel accountable to themselves and to their team, the three cooperative learning elements must be simultaneously in place. First, students need to care about the recognition earned by their team. The PTi3 model suggests teachers use strategies such as having students name their teams name and decorating a box with team-related pictures.

[7]SFAF calls these features "the three central concepts" (team recognition, equal opportunities for success, and individual accountability). The names of the last two concepts were changed in this report for the sake of clarity.

Figure 1

Logic Model for the Success for All Math PowerTeaching Program in Middle Schools



2

Second, to prevent less skilled students from disengaging from learning tasks and relying on the more skilled students to do the work, they must also be able to win points for the team. One specific strategy used in PTi3 is developing team goals that require individual team members to do better academically or behaviorally than they have done previously by, for example, improving their academic or behavioral performance, bringing in their homework more often, or increasing their level of team collaboration. Another strategy is to assign "team roles" (such as recorder or leader) to individual students.

The third element, team interdependence, is the heart of cooperative learning. With the first two elements in place, the PTi3 model creates interdependence by using "random reporter" and other similar strategies, in which the team's performance is assessed based on the performance of one randomly selected team member. In other words, a team earns points based on the quality of a randomly selected team member's homework, exam, or explanation of solutions to math problems when called on during class. The randomness gives students an incentive to help each other understand the math to ensure that *all* team members can represent the team well when the teacher selects their work. Prior research shows that when these three essential elements of PTi3 are simultaneously in place, PTi3 increases students' academic performance. Box 1 shows what the combination of the key elements might look like in the classroom and provides an example of simple group work that is now common in middle school math classes.

The Evaluation

In 2012, MDRC began a multiyear evaluation of PTi3 that included an implementation study to document how PTi3 operated, a school-level randomized controlled trial to determine PTi3's impact on standardized math test scores, and a scale-up study to examine if the goals of the scale-up had been reached. The research team recruited schools in five districts that volunteered to participate in the study and these schools entered the study over the course of two years — 24 schools (all in one state) began in the 2013-2014 academic year (Cohort 1) and 34 schools began in the 2014-2015 academic year (Cohort 2). In each of the five districts in the study, the research team assigned schools to either a program group that received the PTi3 intervention or to a control group that did not. In program group schools, all sixth-, seventh-,and eighth-grade math teachers received PTi3-specific training and support. Teachers in the control group schools received whatever training and support they would usually receive in the absence of the study. The research team continued to recruit schools into 2016 in order to meet the i3 grant's scale-up goals. These schools were not part of the randomized controlled trial and are referred to as "scale-up schools" in this report.

Box 1

Cooperative Learning in Action: Becoming a Super Team

Students are working in teams of four in Ms. Martin's seventh-grade math class. When it comes time to collect homework, it turns out that three members of the purple team have brought in their homework but one, Rudy, has not. The three team members that did their homework are disappointed; not only will they not receive a team "celebration point" for Rudy's homework, but they will not receive the extra point that teams earn when all members of the team bring in their homework. What is more, the team's goal for the week was to improve on completing homework, so now they are behind in their progress toward reaching their goal and accumulating enough points by the end of the math unit to be rated as a Super Team. Rudy promises to make a greater effort to bring in his homework. Ms. Martin then gives the teams a math problem to solve. Rudy and another team member, Malia, have some ideas about how to approach the problem, but the other two are stumped. Malia and Rudy share their ideas with the others to help them understand the problem and how to solve it, because they know that Ms. Martin might randomly call on any one of them to represent the team and explain its solution to the math problem. After giving the teams enough time to work on the problem, Ms. Martin randomly calls on a member of the purple team, Rosario, to share the solution. Rosario's explanation is clear and correct and he receives a high score that counts towards his grade. His team also receives celebration points. By the end of the unit, Rudy has gotten much better at bringing in his homework and the team continues to work collaboratively on math problems. As a result, the purple team receives enough celebration points to become a Super Team and the class celebrates their achievement.

More Typical Group Work That Is Not Cooperative Learning

Ms. Martin collects everyone's homework at the start of class. Most, but not all, have finished it. She then gives the class a math problem to solve and asks the students to form groups of three. Malia, Rosario, and Marie — who are good friends — get together. Malia has some ideas about how to solve the problem, but the other two are stumped. Malia tells the others her solution and assures them that the answer is right, so Rosario and Marie relax. Ms. Martin calls on Rosario to share the solution to the math problem. Rosario tries his best to repeat Malia's answer but knows he is getting it wrong. "Malia can explain it better," he says. "Ok, Malia, what's the answer?" asks Ms. Martin. Malia's answer is correct and very clearly explained. Ms. Martin is pleased because the class has gotten to hear the correct answer explained well.

The majority of the 58 schools in the study are located in urban areas, such as cities, large towns, and on the outskirts of urban areas, or "urban fringe." Table 1 shows how the study sample compared with middle schools nationwide and with the schools in the PTi3 scale-up effort. The first column of Table 1 shows that more than half of the schools in study are located in the West. In order for the research team to conduct a random assignment study of middle schools within a district, the district had to have more than one middle school. This requirement

Table 1

Background Characteristics for Schools in the Study Sample, Schools in the PowerTeaching Scale-Up Sample, and Similar Schools in the National Population (2012-2013 Academic Year)

Characteristics	Study Sample	Scale-Up Sample	National Population[a]
Geographic region (% of schools)		†	†
Northeast	6.9	12.7	16.4 *
South	25.9	29.6	29.3
Midwest	15.5	22.5	27.4 *
West	51.7	35.2 *	26.7 *
Urbanicity (% of schools)		†	†
Large or mid-sized city	44.8	25.4 *	22.3 *
Urban fringe and large town	51.7	40.8	29.4 *
Small town and rural area	3.4	33.8 *	48.3 *
Title I status (% of schools)	91.4	91.5	100.0 *
Eligible for free or reduced-price lunch (average % of students)	72.0	68.7	61.1 *
Race/Ethnicity (average % of students)			
White non-Hispanic	11.5	38.0 *	51.5 *
Black non-Hispanic	31.3	23.3 *	17.2 *
Hispanic	50.5	28.4 *	23.0 *
Asian	4.9	3.6	2.8 *
Other	1.7	6.7 *	5.5 *
Male (average % of students)	48.8	50.7 *	52.1 *
Enrollment (average number of students in Grades 6-8)	961.34	686.76 *	251.66 *
Full-time teachers (average % of teachers of Grades 6-8)	51.6	43.2 *	29.7 *
Sample size	58	71	31,102

(continued)

made it very difficult to include small middle schools in rural areas in the study sample, which explains why more schools in the sample were located in urban areas, compared with PTi3 schools generally or schools nationally.

On average, 72 percent of students enrolled in schools in the study were eligible for free or reduced-price lunch, and 91 percent of the schools were designated Title I schools in the 2012-2013 academic year. On average, schools in the study enrolled more non-white students, compared with PTi3 schools generally or schools nationally. Across all schools in the study, 12 percent of students were non-Hispanic White, 31 percent were non-Hispanic Black, and 51 percent were Hispanic. On average, the middle schools in the study enrolled about 1,000 sixth-, seventh-, eighth-graders and employed 52 teachers, making these middle schools much larger than PTi3 schools generally or middle schools nationally.

Table 1 (continued)

SOURCE: 2012-2013 Common Core of Data.

NOTES: Due to missing values for some variables, the number of schools included varies by characteristic.
"*" indicates a statistically significant difference (p-value < = 0.05) between the study sample and either the scale-up sample or the national population of schools for given characteristics. A two-tailed t-test was applied to each comparison.
"†" indicates a statistically significant difference (p-value <= 0.05) between the study sample and either the scale-up sample or the national population of schools for categorical characteristics. A chi-square test was applied to each of such comparisons.
To examine whether there is any systematic difference between the study sample and the scale-up sample, an F-test was conducted in a regression model controlling all school characteristics reported in this table (p = 0.892). A similar test was conducted for systematic difference between the study sample and the national population (p < 0.001).
[a]The national population includes Title I schools with Grades 6 through 8 only.

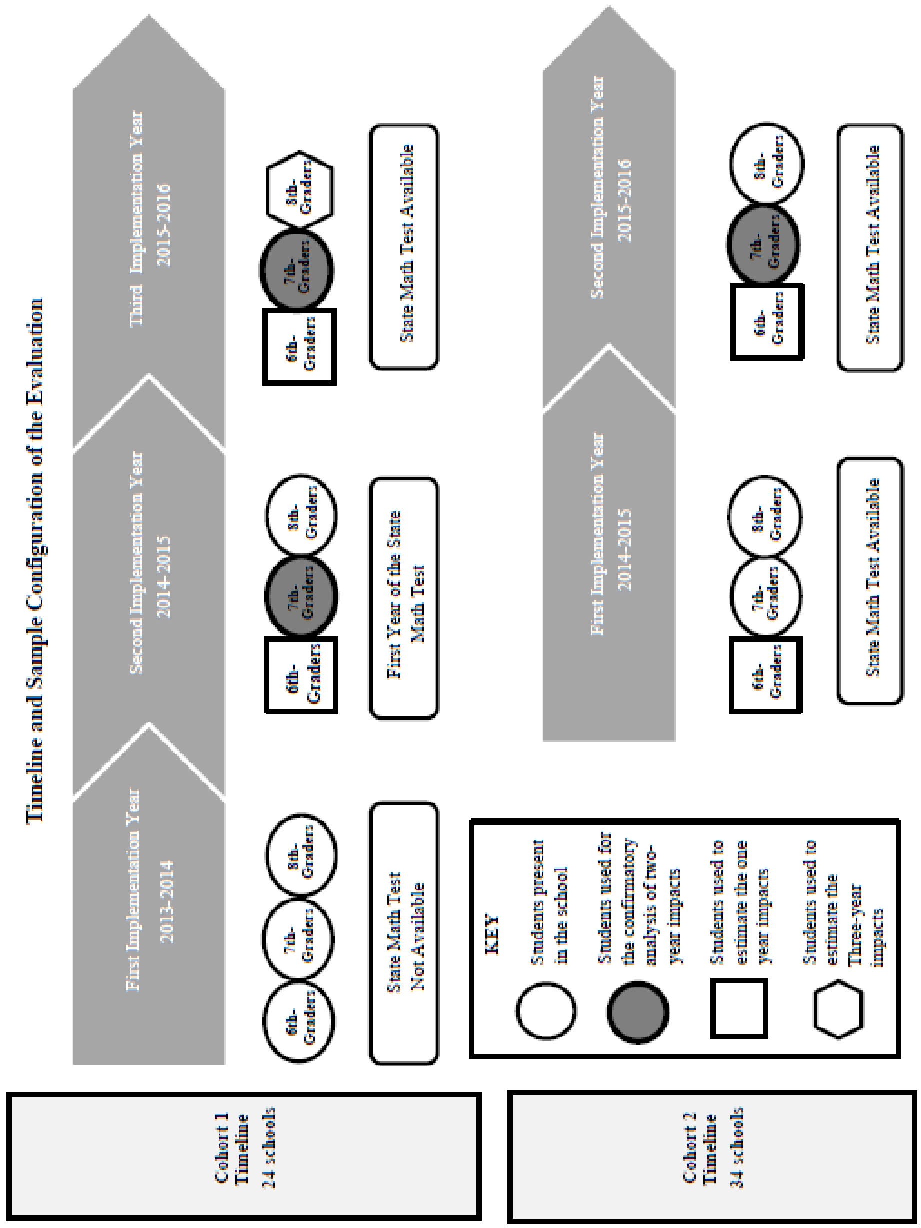
The research team collected data from many sources for the evaluation. The implementation findings use information gathered from both program and control group schools from in-person interviews of school staff, teacher surveys, and instructional logs completed by teachers on a set of randomly chosen students. The impact findings are based on school records collected for students attending both program and control group schools through the 2015-2016 academic year.[8]

Given the time frame of the evaluation, the impact analysis focuses on the one- and two-year (steady state) impacts of PTi3 on students who could have been exposed to the program from the beginning of middle school. Figure 2 indicates which sets of students the research team used to estimate these impacts, showing Cohorts 1 and 2 separately. Because all schools in Cohort 1 were in the same state and the state was refining a standardized test that aligned with its new state standards in the 2013-2014 academic year, test scores were not available that year, making it impossible to observe the one-year impacts in Cohort 1 schools. The one-year impacts are estimated for the sixth-graders (denoted by the square in Figure 2), and the two-year impacts (the confirmatory test) are for seventh-graders who could have experienced PTi3 in both the sixth and seventh grades (denoted by the shaded circle). There is only one set of students who could have been exposed to PTi3 for three years, namely those in Cohort 1 who were eighth-graders in the 2015-2016 academic year (denoted by the hexagon). While the sample of eighth-graders is too small to rigorously test the impact on this group, the research team examined the effect, not expecting statistical significance.

[8]A working paper that is based on data from the 2014-2015 academic year provides a detailed description of these data and is available on the MDRC website in the "Supplemental Materials" for this report (Rappaport et al., 2017).

Figure 2

Timeline and Sample Configuration of the Evaluation



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For interested readers, a longer working paper based on the 2014-2015 academic year is available on the MDRC website in the "Supplemental Materials" for this report.[9]

Most multiyear evaluations encounter obstacles that impinge on the researchers' original plans. A major challenge this evaluation faced was that one of the states in which the study was conducted was adopting new educational standards during the study period. Teachers in program group schools were not only being asked to adopt PTi3 instructional practices, the material they were expected to cover was dramatically changing. Similarly, students were being assessed with new standardized tests. Thus, the educational environment in which teachers in program group schools tried to implement PTi3 may not have been representative of the usual environment in a less stressful time.

The Findings

This section follows the logic model in Figure 1. It begins by determining whether the PTi3 components external to the classroom were in place, then examines the instructional practices teachers used and the dynamics within the cooperative learning teams, and finally assesses the impacts the program generated from this level of implementation. The section concludes with a description of the PTi3 scale-up experience.

- **SFAF and the PTi3 schools provided the requisite time, staff, and materials needed to support teachers in their implementation of the program.**

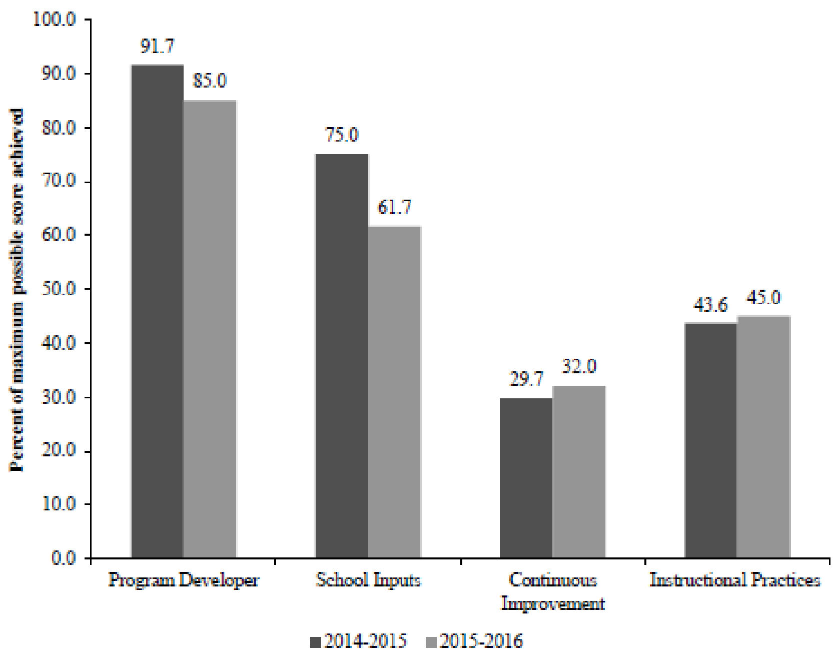
To gauge the fidelity with which schools implemented PTi3, the research team assessed select scores that each school earned on the School Achievement Snapshot (Snapshot), an instrument created by SFAF to guide schools in a continuous improvement process. The facilitators and SFAF coaches jointly decided on which scores from the Snapshots would be used to gauge fidelity. At the beginning of the study, SFAF determined that, for the purpose of this study, if a school achieves a total score of 50 percent or more of the maximum possible score on an implementation measure, then the school should be deemed as having implemented that dimension with adequate fidelity, even if it may be operating PTi3 with fewer than optimal PTi3 teachers or program components in place.

Figure 3 shows that schools received high scores in the Program Developer category, or SFAF's provision of initial training and materials to the schools. The schools also earned

[9]Rappaport et al. (2017). The paper provides many more details on the study's methodology, as well as more detailed evidence supporting the findings.

Figure 3

School Achievement Snapshot Scores, by Category and Academic Year, Study Schools Only



SOURCE: 2014-2015 and 2015-2016 School Achievement Snapshots.

NOTE: The sample includes 12 schools in Cohort 1 and 18 schools in Cohort 2. For Cohort 1 schools, the 2014-2015 and 2015-2016 academic years were Years 2 and 3 of implementation. For Cohort 2 schools, the 2014-2015 and 2015-2016 academic years were Years 1 and 2 of implementation.

adequate scores in the School Inputs category, or schools provision of the required resources such as a part-time facilitator.[10] However, while implementation was over 50 percent on both of these measures in both years, scores declined in the 2015-2016 academic year.

[10]The scores for Program Developer and School Inputs categories were each based on two Snapshot items.

- **Few schools carried out the ongoing continuous improvement activities specified by the PTi3 model, as the low scores (below the adequacy threshold of 50 percent) in the Continuous Improvement category indicate. Few schools collected and used student assessment data to drive instruction, and most teachers did not receive the kind of training and support from the school-level facilitator that the PTi3 model specified in order to help teachers create cooperative learning teams in their classrooms.[11]**

Figure 3 shows that the study schools scored about 30 percent of its maximum value in the Continuous Improvement category both years. The score was slightly higher in the 2015-2016 academic year, but still below the adequacy threshold.[12] As shown in Table 2, the schools held component team meetings less often than twice a month as prescribed by the PTi3 model. When these meeting did occur, they often did not focus on setting goals, monitoring program implementation, and going over student data — the core purpose of these meetings — since very few schools collected the necessary data on student assessment and teacher implementation. Finally, very few schools used the coaching method prescribed by SFAF to help math teachers master cooperative learning in their classrooms. Thus, the average score in this category is low across the sample. Despite receiving less support than prescribed by the PTi3 model, a significantly greater proportion of teachers in program group schools than in control group schools reported in surveys that they had received coaching.[13]

- **Students in both program and control group schools worked in groups often, but math teachers in program group schools were more likely than teachers in control group schools to put students in longstanding mixed-ability groups (per the PTi3 model), which are more conducive to building strong cooperative learning teams. Students in program group schools spent more time each day in these teams.**

The educational standards recently adopted by the states in which the evaluation was conducted support frequent student collaboration in math classes, and the study found that most classrooms in the study sample included group work. However, simply putting students in a

[11]One of the main responsibilities of the school-level facilitator is to support and train teachers in the PTi3 model. SFAF coaches train the facilitators, who are then expected to train the teachers in their schools.

[12]The scores for the Continuous Improvement were based on four Snapshot items.

[13]Math teachers in both program and control schools were surveyed at the end of the 2014-2015 academic year.

Table 2

School Achievement Snapshot Scores for Items Related to Schoolwide Structures and Instructional Practices, Study Schools (2014-2015 and 2015-2016 Academic Years)

Item	2014-2015 Percent of maximum possible score	2015-2016 Percent of maximum possible score
Program developer		
All leaders and staff have received essential training	83.3	76.7
Materials for program implementation are complete	100.0	93.3
School inputs		
School-based math facilitator is a part-time position	80.0	56.7
The principal is fully involved with PowerTeaching	70.0	66.7
Continuous improvement processes		
Component teams meet at least twice a month	43.3	45.0
Each teacher submits a quarterly classroom assessment summary	18.3	5.0
Instructional component teams set targets, chart progress, and work to meet targets	25.0	31.7
The school-based math facilitator uses PowerTeaching coaching process	18.3	34.5
Instructional practices		
Teachers...		
Use basic lesson structure, objectives, and available media regularly and effectively	57.7	54.0
Use think-pair-share, whole-group response, or random reporter frequently and effectively	45.3	46.7
Provide time for partner and team talk to allow mastery of learning objectives by all students	55.7	62.0
Facilitate partner and team discussion	38.3	46.3
Randomly select students to report for their teams during class discussion, use rubrics to evaluate responses, and award teams with points	30.7	37.3
Effectively summarize and address misconceptions or inaccuracies during class discussion	20.0	14.7

SOURCES: 2014-2015 and 2015-2016 School Achievement Snapshots.

NOTES: The sample includes 12 schools in Cohort 1 and 18 schools in Cohort 2. For Cohort 1 schools, the 2014-2015 and 2015-2016 academic years were Years 2 and 3 of implementation. For Cohort 2 schools, the 2014-2015 and 2015-2016 academic years were Years 1 and 2 of implementation.

group does not necessary mean they will collaborate as a cooperative learning team to solve problems. Cooperative learning teams require structure and guidance and take time to gel.[14] The teacher survey results show that, on average, student groups in PTi3 schools stayed together for longer periods of time, allowing students to bond as a team. Teachers in PTi3 schools were also less likely to separate individual students from their groups when academic or behavioral issues arose. Finally, groups in PTi3 schools were more likely to have four students,[15] compared with groups of three students in control group schools. Thus, longstanding, mixed-ability teams, as prescribed by the PTi3 model, were more prevalent in program group schools. Students in PTi3 schools also spent significantly more time working in groups (59 percent of class time) than students in control group schools (40 percent of class time). When teachers logged the activities of a randomly chosen set of students, the data showed that students in an average math class in program group schools spent significantly more time doing team work than students in control group schools by an average of 10 minutes (31 minutes versus 21 minutes).

- **Despite differences in how math teachers in program group and control group schools structured student groups and used teamwork, fewer than half of the teachers in program group schools incorporated the PTi3 instructional strategies in their classrooms. Many teachers in program group schools put cooperative learning team structures in place but did not use the strategies that move group work to true cooperative learning teams.**

Students in cooperative learning teams collaborate on problems, not just to find the right answer, but to ensure all team members know how to solve similar problems, or have learned the skill. The scores in the Instructional Practices category in Figure 3 and the scores on the corresponding items in Table 2 indicate that teachers in program group schools were not implementing, with adequate fidelity, the PTi3 strategies intended to foster cooperative learning teams. Table 2 shows that the teachers' scores on using basic PTi3 lesson plans and objectives and providing time for partner and team talk were just over the adequacy threshold of 50 percent. However, teachers scored below the adequacy threshold on all the other items in the Instructional Practices category. Importantly, teachers overall scored below the adequate mark on using the random reporter, a critical strategy that gives students an incentive to ensure that all team members can answer questions correctly.

[14]Tuckman (1965).

[15]With four students in a group, there is more opportunity for partnership as it is possible to have students work in pairs within the group.

- **The dynamics between students inside the groups did not appear to differ greatly between program and control group schools, although a few different behaviors were observed.**

The instructional logs provide a detailed picture of what students did in their groups.[16] On average, students in PTi3 schools spent 31.3 minutes working in groups, compared with 21.3 minutes for students in control schools. The top row of Table 3 shows that, on average, students in PTi3 schools spent 8.4 minutes jointly solving math problems using an algorithm, compared with 5.2 minutes for students in control group schools. The average student in PTi3 schools also spent a little more time than students in control group schools engaging in activities not related to the group assignment (3.8 minutes versus 1.9 minutes), with students in PTi3 schools spending 1.5 of those minutes bothering other students (versus 0.6 minutes for students in control group schools). No other significant differences were observed.

Subgroups of students defined by skill level drove these differences. The students in PTi3 schools that the teacher rated as in the top third of their math class had similar in-group experiences in the program and control group schools. Students in the middle or bottom third of their class demonstrated changed behaviors. These students were more likely than their counterparts in control group schools to jointly solve math problems. (Students in the middle third spent 8.5 minutes jointly solving math problems, compared with 4.8 minutes for their counterparts in control group schools; students in the bottom third spent 7.1 minutes, compared with 3.7 minutes for their counterparts in control group schools). Differences in negative behaviors were entirely concentrated among students ranked in the bottom third. (These students in the lower third spent 6.4 minutes engaging in negative behaviors, versus 3.0 minutes for their counterparts in control group schools.)

- **The three elements that must be simultaneously in place to create interdependent cooperative learning teams — team recognition, equal opportunity for all students to contribute to the team's success, and team interdependence — were not consistently in place. Strategies to promote interdependence, in particular, were not well understood or implemented by teachers.**

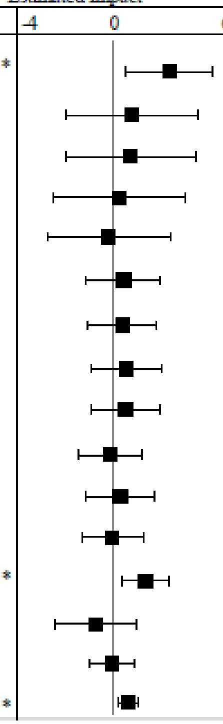
Teacher surveys and focus groups indicate that some teachers in PTi3 schools used strategies supporting team recognition or team identity, but primarily at the beginning of the

[16]In the 2014-2015 academic year, math teachers in program and control group schools were asked to fill out a daily log for a two-week period. Each entry would focus on one student, and teachers would complete daily entries for up to eight students that researchers randomly selected from their classes. Logs record what the student did during class.

Table 3

Impact of PowerTeaching on Minutes Students Spent Doing Group Activities During the Math Block (Activities Are Not Mutually Exclusive)

Activity	Mean Program Minutes	Mean Control Minutes	Estimated Impact[a]	90% Confidence Interval
Solving mathematical problems by using an algorithm	8.42	5.22	3.19 *	(0.74 5.64)
Discussing and working on a problem with multiple solution methods	8.06	6.98	1.08	(-2.64 4.80)
Applying mathematical concepts to "real world" problems	7.82	6.84	0.98	(-2.71 4.67)
Representing and analyzing relationships using tables or models	6.71	6.35	0.36	(-3.38 4.10)
Analyzing data to make inferences or draw conclusions	5.54	5.80	-0.26	(-3.76 3.24)
Explaining a solution to a problem to other students	5.47	4.89	0.57	(-1.52 2.67)
Helping other students solve math problems	5.20	4.68	0.52	(-1.42 2.47)
Asking other students clarifying questions	5.06	4.29	0.77	(-1.20 2.73)
Asking other students for help in solving a math problem	4.85	4.17	0.67	(-1.29 2.64)
Exchanging work with other students for review and checking	4.82	4.99	-0.17	(-2.00 1.65)
Suggesting a strategy to a partner or group members	4.61	4.23	0.38	(-1.52 2.28)
Building on or challenging the ideas of other students	3.93	3.99	-0.06	(-1.82 1.70)
Engaging in discussion or activities not related to assigned activity	3.77	1.94	1.83 *	(0.51 3.16)
Jointly reading a textbook or supplementary materials	2.48	3.44	-0.97	(-3.28 1.35)
Discussing and jointly working on multiple choice exercises	2.23	2.33	-0.11	(-1.39 1.18)
Making fun of, belittling, or bothering a partner or group members	1.49	0.64	0.85 *	(0.27 1.43)



(continued)

Table 3 (continued)

SOURCE: Teacher logs administered in spring 2015.

NOTES: Sample consists of 2,941 logs (1,567 in the program group and 1,374 in the control group). There was a low response rate from teachers in one school district. As a result, all instructional logs (n = 84) from this district were dropped.

All estimations are based on a three-level hierarchical model with individual logs nested within teachers and teachers nested within schools. A two-tailed t-test was applied to each estimated difference. Statistical significance is indicated by an asterisk (*) when the p-value is less than or equal to 5 percent.

In the instructional logs, teachers were asked how much time randomly selected students spent working in three different configurations during the mathematics period: in groups, in pairs, and individually. If teachers indicated that selected students worked in a group during the mathematics period, they were asked approximately what proportion of group time the students spent engaging in specific activities using a five-category scale: 0 percent, less than 10 percent, 10 to 25 percent, 26 to 50 percent, and more than 50 percent. In the analysis of the logs, the research team converted the proportion of group time into minutes by calculating the midpoint of the ranges in this scale and then multiplying the midpoint of the selected range by the total amount of time spent working in a group. If selected students did not spend time working in a group, the time spent on each activity was set to zero.

[a]The horizontal lines on each side of the impact estimate represent the "confidence interval" — that is, the range of estimated values of the impact, within which there is a 90 percent probability that the true value falls. The impact estimate is statistically significant when the range of the confidence interval (defined by the upper and lower bounds) crosses the vertical line.

year. Teachers seemed to inconsistently use strategies promoting equal opportunities for all students to contribute to the team's success. Data from focus groups indicate that some teachers in program group schools used strategies such as rewarding team points, assigning team roles, and developing team goals, but they did not do so consistently. Given that the logs showed misbehavior was higher in program group schools than in control group schools — and concentrated in the students in the bottom third of their class — it appears that more needed to be done to fully engage this group. Finally, teachers did not seem to understand random reporter and other strategies that promote group interdependence very well.

While many teachers in both program and control group schools reported that they sometimes used a random reporter strategy to call on students to answer math questions, some of them reported that they allowed randomly selected students to pass the questions to a teammate or to confer with their team before answering, and some described only randomly picking students who had not yet had a chance to share a response.[17] As a result, these teachers did not create team interdependence since the most advanced team member often answered questions when a less advanced team member could not, without repercussions such as withholding team points or rewards. Teachers in PTi3 schools demonstrated a similar misunderstanding of interdependence strategies when they reported letting students work on their tests together. This

[17]Teachers also reported using other ways of calling on students, including calling on volunteers, calling on students who rarely volunteered or who were not paying attention, or calling on lower-performing students when it was evident that they had a strong response to share.

approach, once again, allowed for the most advanced team member to correct the errors made by the less advanced members, rather than ensure that all team members could correctly complete the test themselves. Teachers would have created group interdependence if they had encouraged team members to prepare for the test together but required them to take their tests independently.

- **Based on the analysis of the full sample, the PTi3 program did not produce statistically significant impacts on math performance of the sixth-, seventh-, or eighth-graders, as measured by their scores on the state's standardized math test.**

As Table 4 shows, the estimated one-year impact on sixth-graders' standardized math score is approximately zero and insignificant. The estimated two-year impact on math scores for seventh-graders, our confirmatory hypothesis, is also close to zero (with a p-value of 0.931). Finally, the estimated impacts on eighth-graders in Cohort 1 — who were the only students in the sample that could have experienced PTi3 during all three years of middle school — is also not statistically different from zero (with a p-value of 0.222). However, this estimate is based on a sample of less than half the schools in the study, which is not large enough to determine statistical significant at the desired 80 percent level of power. (In other words, the estimation is underpowered).

It is important to note that schools in this sample were experiencing the PTi3 program with differing maturity, and some schools were administering a new state standardized math test for the first time. The research team conducted several sensitivity analyses to see if the estimated impacts differed by program maturity or if they were obscured because some schools were using the new standardized test for the first time. None of these analyses yielded statistically significant findings.[18]

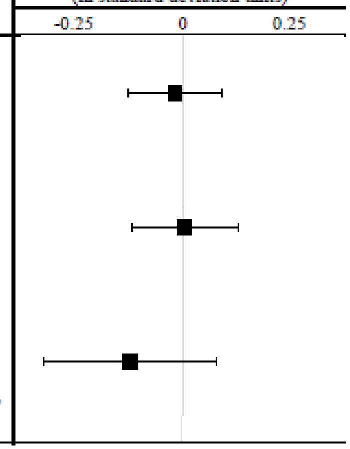
- **Impact analyses on subgroups of the confirmatory sample, however, found that the impacts differed significantly by cohort. The estimated impact for seventh-graders in Cohort 2 who could have received the**

[18]An analysis of only students in seventh grade during their schools' second year implementing PTi3 (seventh-graders in Cohort 1's 2014-2015 academic year and seventh-graders in Cohort 2's 2015-2016 academic year) did not reveal any significant impacts. In addition, if the seventh-graders in Cohort 1's 2014-2015 academic year were dropped from the analysis because they were assessed using a new state test for the first time that year and if the estimated impact is based on only seventh-graders in the 2015-2016 academic year, then the estimated impact is 0.01 and not significant (p-value of 0.91). However, the study is not powered for this kind of subgroup analysis, therefore all results presented here are considered exploratory and should be interpreted as such.

Table 4

Impact of PowerTeaching on Students' Average Math Achievement by Grade, for Analysis Samples

Sample	Program Group	Control Group	Estimated Impact (in Effect Size or Percentage Point)	P-Value	95% confidence interval of the impact[a] (in standard deviation units)
Grade 6 full sample (exploratory)					
Standardized state math test score	-0.07	-0.05	-0.01	0.747	
Percentage at or above proficiency level	30.1	31.8	-1.8	0.304	
Number of schools	58				
Grade 7 full sample (confirmatory)					
Standardized state math test score	-0.05	-0.05	0.00	0.931	
Percentage at or above proficiency level	32.1	32.3	-0.2	0.896	
Number of schools	58				
Grade 8 full sample (exploratory)					
Standardized state math test score	-0.16	-0.06	-0.09	0.222	
Percentage at or above proficiency level	21.2	27.0	-5.8	0.049 *	
Number of schools	24				



(continued)

Table 4 (continued)

SOURCES: School district student records data from the 2015-2016, 2014-2015, 2012-2013 academic years (for Cohort 1), and the 2013-2014 academic year (for Cohort 2).

NOTES: The analysis sample consists of students from 58 schools (30 program group schools and 28 control group schools) and includes any student who had a valid spring test score in the spring of 2015 or spring of 2016.

The student sample size for Grade 6 (Cohort 1 and Cohort 2 schools in both 2014-2015 and 2015-2016 academic years) is 32,288 students (17,354 in the program group schools and 14,934 in the control group schools). The sample size for Grade 7 (Cohort 1 schools in the 2014-2015 and 2015-2016 academic years, and Cohort 2 schools in the 2015-2016 academic year) is 26,808 students (14,489 in the program group schools and 12,319 in the control group schools). The student sample size for Grade 8 (Cohort 1 schools in the 2015-2016 academic year) is 9,139 students (5,117 in the program group schools and 4,022 in the control group schools).

The estimated impacts are based on a two-level model with students nested within schools, controlling for random assignment block and school- and student-level covariates. The program group and control group columns display regression-adjusted mean outcomes for each group, using the mean covariate values for students in the program group schools as the basis for the adjustment. Rounding may cause slight discrepancies in calculating sums and differences.

"*" indicates a statistically significant difference (p-value < = 0.05) between comparison groups for given characteristics. A two-tailed t-test was applied to each comparison.

[a]The confidence intervals are for the estimated impacts on the standardized test scores.

PTi3 program for two years was positive, but not statistically different from zero, while the estimated impact for similar seventh-graders in Cohort 1 was negative and significant.

The top panel of Table 5 shows that the impact for Cohort 1 is -0.12 and statistically significant (with a p-value of 0.047), while the impact for Cohort 2 is 0.08 and not statistically significant (with a p-value of 0.285). These two estimated impacts are statistically different from each other (p-value of 0.044). An impact analysis by cohort for sixth-graders (not shown in Table 5) yielded no statistically significant findings. The impact for sixth-graders in Cohort 1 was -0.10, while it was 0.04 for sixth-graders in Cohort 2.

One possible explanation for Cohort 1's smaller impact findings could be that the study period overlapped with the year when one of the states in which the study took place adopted the state's new educational standards. This state — where all Cohort 1 schools are located — introduced a standardized test to hold schools accountable for the new standards the same year schools in Cohort 1 entered the study. Teachers in Cohort 1 schools were being asked to adopt PTi3 instructional strategies *and* to cover new material. Interviews with teachers indicate that they struggled with how best to teach the material in accordance with the new standards. SFAF responded by developing teaching resources for math that aligned with the new standards during the first two years of the study. However, it took SFAF a few years to fully develop and refine these curricular materials. Thus, it is not surprising that students who experienced the

Table 5

Impact of PowerTeaching on Students' Average Math Achievement for Grade 7 Analysis Sample, by Cohort and Student Subgroup

Subgroup	Number of Observations	Program Group	Control Group	Estimated Impact (in Effect Size or Percentage Point)	P-Value
By cohort (exploratory)					†
Cohort 1					
Standardized state math test score	18,539	-0.11	0.01	-0.12	0.047 *
Percentage at or above proficiency level	18,539	22.3	26.6	-4.3	0.056
Cohort 2					
Standardized state math test score	8,269	-0.01	-0.09	0.08	0.285
Percentage at or above proficiency level	8,269	38.5	35.9	2.6	0.368
By performance rank at baseline					
Top third	7,408	0.68	0.72	-0.04	0.589
Middle third	7,927	0.04	0.04	0.00	0.920
Bottom third	7,680	-0.74	-0.77	0.03	0.521
By proficiency level at baseline					
At or above proficiency	14,604	0.43	0.45	-0.02	0.687
Below proficiency	8,378	-0.60	-0.61	0.01	0.807
By gender					
Boys	13,696	-0.09	-0.08	-0.01	0.835
Girls	13,023	0.00	0.00	0.00	0.931
By race/ethnicity					
Hispanic	18,118	-0.19	-0.14	-0.04	0.377
White, Non-Hispanic	2,917	0.39	0.46	-0.07	0.397
Black, Non-Hispanic	3,451	-0.25	-0.28	0.02	0.623
By family income					
Eligible for free and reduced-price lunch	19,458	-0.08	-0.09	0.01	0.753
Not eligible for free and reduced-price lunch	4,880	0.20	0.30	-0.10	0.149
By English-language learner (ELL) status					
ELL	4,036	-0.70	-0.63	-0.08	0.125
Non-ELL	18,773	0.08	0.07	0.01	0.838
By special education (SPED) status					
SPED	2,985	-0.82	-0.84	0.02	0.744
Non-SPED	23,499	0.07	0.07	0.00	0.975

(continued)

Table 5 (continued)

SOURCES: District student records data from the 2015-2016, 2014-2015, and 2012-2013 academic years (for Cohort 1), and the 2013-2014 academic year (for Cohort 2).

NOTES: The Grade 7 analysis sample consists of students from 58 schools (30 program group schools and 28 control group schools) and includes any student who had a valid spring test score in the spring of 2015 (Cohort 1) or spring of 2016 (both Cohorts 1 and 2). The sample size for Grade 7 is 26,808 students (14,489 in the program group schools and 12,319 in the control group schools).

The estimated impacts are based on a two-level model with students nested within schools, controlling for random assignment block and school- and student-level covariates. The program group and control group columns display regression-adjusted mean outcomes for each group, using the mean covariate values for students in the program group as the basis for the adjustment. Rounding may cause slight discrepancies in calculating sums and differences.

The difference between the impact estimates for Cohorts 1 and 2 is significant at the 5 percent level (p = .044).

"*" indicates a statistically significant difference (p-value < = 0.05) between comparison groups for given characteristics. A two-tailed t-test was applied to each comparison.

"†" indicates a statistically significant difference (p-value <= 0.05) in impacts among subgroups.

early materials (students in Cohort 1 schools) fared less well on the standardized test than those who experienced the more refined materials (students in Cohort 2 schools).

- **A subgroup analysis of students based on socioeconomic and academic characteristics did not reveal that impacts varied across these groups, nor did it find any statistically significant impacts.**

The research team also explored potentially heterogeneous impacts across different student subgroups defined by baseline characteristics. These subgroups included those defined by students' performance levels in math, gender, race or ethnicity, English language learner (ELL) status, poverty status, and special education status. Table 5 presents results of this exploratory analysis for the sample of seventh-graders. Overall, the findings indicate that the PTi3 program did not produce any statistically significant impacts across a range of student subgroups, and these findings did not seem to vary across such subgroups.

- **As of October 2016, Old Dominion University calculated that the PTi3 program served 132,166 students in 106 high-need schools over the course of the i3 scale-up effort, which put them at 98 percent of their target of 135,000 students. Most of these scale-up schools were smaller and implemented PTi3 slightly better than the schools in the study, according to Snapshot scores.**

The second column of Table 1 shows that the scale-up schools, similar to the schools in the study, were high-need schools (92 percent were Title 1 schools), but they were more geographically dispersed, less urban, and smaller in size than schools in the study sample.[19] The total of 132,166 students served includes the students in 8 pilot schools,[20] the 30 schools in the study's program group, and 41additionally recruited scale-up schools.[21] After recruitment for the study ended, districts and schools could join the project as scale-up sites and were eager to do so. Of the schools offered to participate in the scale-up, about 90 percent joined the project. Scale-up schools did not have to go through the random assignment process and the i3 grant paid for implementation costs to varying degrees, depending on the year that a school was recruited and its level of participation in helping to improve the program.

The research team also gauged the fidelity with which these additional scale-up schools implemented PTi3 using their Snapshot scores in the 2015-2016 academic year, shown in Figure 4.[22] Similar to the program group schools, the scale-up schools scored above the adequacy threshold in the Program Developer and School Inputs categories. Unlike the schools in the study, the scale-up schools also scored above the adequacy threshold in the Continuous Improvement category. However, the scale-up schools similarly fell short of the adequacy threshold in the Instructional Practices category. Thus, while implementation of PTi3 remained weak, the scale-up schools implemented the program with more fidelity than schools in the study.

Conclusion

The evaluation's findings show that training middle school math teachers to create an effective cooperative learning environment is hard. When a school-based intervention requires both structural and instructional changes, as PTi3 did, it is not uncommon to observe that it is easier for the schools to put the new structures in place than for the teachers to change their instructional practices. For example, a recent evaluation of Diplomas Now — a comprehensive, schoolwide model that includes structural changes, the introduction of new instructional

[19]In order to conduct a random assignment of middle schools within a district, the district had to have more the one middle school. This requirement made it almost impossible to include small rural middle schools in the study sample.

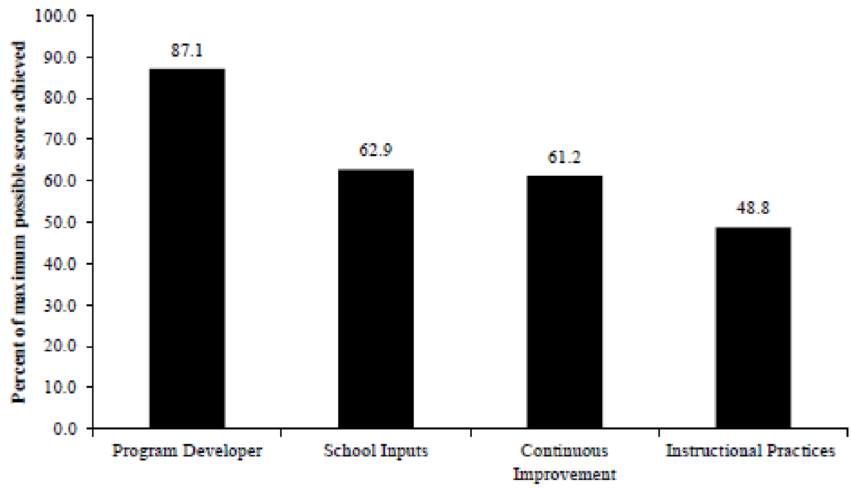
[20]In the first year of the PTi3 project, before the study schools and the scale-up schools were recruited, the program was piloted in eight schools.

[21]By the 2016-2017 academic year, a total of 157,183 students had been served in 134 schools, which put the number of students being served over the 135,000 student target. The 28 additional schools were the study's control group schools, which received access to the program after the final follow-up data was collected.

[22]There were a total of 41 non-study scale-up schools by the 2015-2016 academic year, but Snapshot scores were only available for 39 schools. The Snapshot scores for schools in the study were from the 2015-2016 academic year. The scale-up schools also varied in the number of years they had been implementing the program.

Figure 4

2015-2016 School Achievement Snapshot Scores, by Category, Scale-Up Schools Only



SOURCE: 2015-2016 School Achievement Snapshots.

NOTE: In total, there were 41 non-study scale-up schools by 2015. Snapshot scores were available for 39 of these schools.

materials and curricula, teacher and administrator coaching and support, and a student early warning system — found that, while schools were reasonably successful at implementing many parts of the model, they were least successful at making the instructional and curricular changes.[23] These findings are quite similar to those found in the PTi3 evaluation. Changing instruction and teaching practices may just take more time and concerted attention. Similar to earlier studies, the present evaluation's findings also suggest that placing students in mixed-ability groups has a positive impact on student performance only if true interdependence among group members occurs. However, since math teachers today incorporate student group work in their classrooms more frequently, the potential to improve student performance in math through effective cooperative learning strategies is great. Research shows that enhancing the instructional practices of math teachers has the largest marginal effect on improving performance among secondary students, compared with other commonly used practices such as changing the math curriculum or supplementing teacher instruction with computer-assisted instruction.[24]

[23]Sepanik et al. (2015).

[24]Slavin, Lake, and Groff (2009).

Given that overall implementation of PTi3 among schools in the study was weak, the findings are not a fair measure of the program's true effect when properly implemented. Implementation of PTi3 during the study period was hampered by an unusual event — states where the evaluation was conducted were adopting new educational standards. As a result, school districts were introducing new and much more difficult standardized tests that aligned with these standards. Principals and teachers were struggling with how best to instruct the material in accordance with the new standards and standardized tests. While teachers attempted to implement PTi3 and adopt its instructional strategies, they also struggled to teach new and different material and prepare their students for new tests. Thus, the continuous improvement component of the PTi3 model, which is critical to helping teachers master effective cooperative learning strategies, did not occur at the level the model specifies.

This finding points to an important yet underemphasized need to help teachers across the country understand how to use group work in a way that creates an effective cooperative learning environment. Unlike the 1980s and 1990s, when middle school teachers mostly relied on the traditional teaching method of demonstration followed by individual student practice,[25] middle school teachers today almost universally incorporate group work into their classroom instruction. This study showed that 96 percent of teachers in the control group schools were using peer-learning strategies, namely partner or group work, in their classes. However, the qualitative data also shows that, for the most part and similar to the teachers in the program group schools, they were not creating environments of positive interdependency among group members. Thus, while it is not difficult to convince math teachers that group learning activities are a useful instructional strategy, there still remains a crucial need to help teachers turn this group work into effective cooperative team learning.

One solution may be to scale up a more refined version of the PTi3 model to more schools. Indeed, the scale-up schools appeared to implement PTi3 with greater fidelity. However, this study's findings show that no matter what instructional program schools adopt to improve cooperative learning, they must provide sufficient training and support to ensure teachers understand and master the strategies that engender a truly interdependent cooperative learning environment. Simply having students work in groups, even in longstanding heterogeneous teams, is not enough. Teachers must manage their classroom so that all students are invested in their teams' achievement, have opportunities to help the team, and receive both individual and team recognition from their individual performance and not from the performance of other team members.

[25]McKinney and Frazier (2008).

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About MDRC

MDRC is a nonprofit, nonpartisan social and education policy research organization dedicated to learning what works to improve the well-being of low-income people. Through its research and the active communication of its findings, MDRC seeks to enhance the effectiveness of social and education policies and programs.

Founded in 1974 and located in New York; Oakland, California; Washington, DC; and Los Angeles, MDRC is best known for mounting rigorous, large-scale, real-world tests of new and existing policies and programs. Its projects are a mix of demonstrations (field tests of promising new program approaches) and evaluations of ongoing government and community initiatives. MDRC's staff members bring an unusual combination of research and organizational experience to their work, providing expertise on the latest in qualitative and quantitative methods and on program design, development, implementation, and management. MDRC seeks to learn not just whether a program is effective but also how and why the program's effects occur. In addition, it tries to place each project's findings in the broader context of related research — in order to build knowledge about what works across the social and education policy fields. MDRC's findings, lessons, and best practices are proactively shared with a broad audience in the policy and practitioner community as well as with the general public and the media.

Over the years, MDRC has brought its unique approach to an ever-growing range of policy areas and target populations. Once known primarily for evaluations of state welfare-to-work programs, today MDRC is also studying public school reforms, employment programs for ex-offenders and people with disabilities, and programs to help low-income students succeed in college. MDRC's projects are organized into five areas:

- Promoting Family Well-Being and Children's Development
- Improving Public Education
- Raising Academic Achievement and Persistence in College
- Supporting Low-Wage Workers and Communities
- Overcoming Barriers to Employment

Working in almost every state, all of the nation's largest cities, and Canada and the United Kingdom, MDRC conducts its projects in partnership with national, state, and local governments, public school systems, community organizations, and numerous private philanthropies.

Appendix B
MDRC Study Documentation

ICPSR | INTER-UNIVERSITY CONSORTIUM FOR POLITICAL AND SOCIAL RESEARCH

ICPSR 37046

Evaluation of Success for All PowerTeaching in Middle School Grades, United States, 2012-2016

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Study Documentation

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ICPSR PROCESSING NOTES FOR #37046
Evaluation of Success for All PowerTeaching in Middle School Grades, United States, 2012-2016

1. **File Naming Conventions:** Original data files were provided to ICPSR in SAS format. In the process of making the data available in the full data suite (SPSS, SAS, Stata, R, ASCII), ICPSR has changed the original SAS file names to correspond to ICPSR naming conventions.. Some references to the original file names still exist in the documentation provided by the PIs. Users should consult the file name crosswalk below for any questions about the original and new file name conventions:

Data File Number	ICPSR Dataset Name	Original SAS File Name
1	Primary Student-Level Data File	sfama_imp_ruf.sas7bdat
2	Snapshot Data File, 2014-2015	sfama_snaps15_ruf.sas7bdat
3	Snapshot Data File, 2015-2016	sfama_snaps16_ruf. sas7bdat
4	Teacher-Level Data File, Spring 2015	sfama_tsvy15_ruf.sas7bdat
5	Teacher-Level Data File, Spring 2016	sfama_tsvy16_ruf.sas7bdat
6	Principal Survey Data File, Spring 2015	sfama_psvy15_ruf.sas7bdat
7	Principal Survey Data File, Spring 2016	sfama_psvy16_ruf.sas7bdat
8	Teacher Log Data File, 2014-2015	sfama_tchlogs15_ruf.sas7bdat
9	Teacher Log Data File, 2015-2016	sfama_tchlogs16_ruf.sas7bdat
10	Scale-up and Study Schools Data File	sfa_sch_ruf.sas7bdat

2. **Stata Limitations**: Due to Stata limitations, the following string variables do not contain their assigned value labels within the Stata files:
   - Primary Student-Level Data File (DS1): variable **TRANSFER**
   - Principal Survey Data File (DS6): variables **PSQ23_15** and **PSQ5H**

FOR SDA ONLY:

1. **Sequential Record Identifier:** ICPSR created a unique sequential record identifier variable named **CASEID** for use with online analysis.

2. **Additional Information:** Please note that the Study Documentation and Data Collection Instruments can be accessed via the "Full Study Documentation" link.

Success for All Reading Restricted Use File Documentation

Introduction

This document first provides a brief overview of the Success for All PowerTeaching (PT) scale-up evaluation and the structure and content of released data files.

The Success for All PowerTeaching scale-up evaluation, funded under the U.S. Department of Education's Investing in Innovation (i3) competition, examines PowertTeaching implementation and impacts in five school districts over a two-year period (the 2014-2015 school year through the 2015-2016 school year). It also considers the scale-up process itself — the methods employed and the extent to which the Success for All Foundation (SFAF), the organization that developed and provides technical assistance to schools operating the program, achieved its scale-up goals. \

SFAF developed the PowerTeaching model used in the i3 scale-up evaluation based on over 25 years of extensive research and refinement of the model. The model aims to prepare students to meet the stringent demands of new state math standards, both the knowledge standards and the 21st-century skills standards, such as communication and collaboration. Its components are intended to provide teachers with the necessary tools to incorporate cooperative learning strategies into their instructional practices. In particular, the PT model requires that teachers place students in longstanding heterogeneous skill groups and provide them with structured opportunities to practice the three key elements of cooperative learning teams:

- Team recognition — students embrace team identity and care about the team's performance
- Equal opportunities for all students to help the team — all team members, no matter their ability, can contribute to the team goals by improving on their past performance
- Team interdependence — team success depends on each individual's learning, while an individual's grade depends only on his or her own performance

The recruitment for the evaluation was conducted by the Success for All Foundation (SFAF) and occurred as part of the general outreach to schools, districts, and states for the i3 scale-up grant. Each school had to meet the following eligibility criteria: It had to serve students in Grades 6 through 8[1], it had to be eligible for Title I status, it had to be willing to comply with the study's data request, and at least 75 percent of its teachers had to vote to adopt the PTi3 program.

Recruitment for the study was initially a challenge because districts that were interested in the program often wanted the benefits for their entire school population as soon as possible and were reluctant to identify schools to serve as control schools. Additionally, although including demographic diversity, and specifically rural schools, was a core feature of the project, it was a unique challenge. Rural school

[1] One of the recruited study schools was serving a high proportion of low-income students but was not designated as a Title I school in the baseline year in the Common Core of Data (CCD. It became a Title I school in the subsequent year

districts often do not have multiple middle schools to serve as program and control sites. The initial round of recruitment efforts produced a sample of schools (Cohort 1 schools) that was not adequate for the impact study. The recruitment timeline was extended and more districts and schools were recruited for the following fall through a second round of efforts (Cohort 2 schools).

At the end of the recruitment phase, five school districts in four states agreed to participate in the study. The number of study schools provided by each district ranged between 4 and 24, producing a total sample of 58 schools. Of these 58 schools, 24 schools were Cohort 1 and 34 schools were in Cohort 2.

To be recruited, scale-up schools had to serve a large fraction (more than 50 percent) of minority students or students who were eligible for free or reduced-price lunch in Grades 6 through 8. Compared with the scale-up sample, the study schools had a similar proportion of students eligible for free and reduced-price lunch and were equally likely to be designated Title I schools.

Overview of Data Provided

This section gives an encapsulated overview of the datasets provided in tabular form. In subsequent sections, each dataset is documented in more detail, with attention given to file organization, key variables, naming conventions, and methodological issues.

SAS Data File Name	Description
sfama_imp_ruf.sas7bdat	This dataset contains baseline and yearly test scores, as well as demographic data middle school (6-8 grade) students in 2014-2015 and 2015-2016. Cohort 1 baseline data is from the 2012-2013 academic year. Cohort 2 baseline data is from the 2013-2014 academic year.
sfama_snaps15_ruf.sas7bdat	The School Achievement Snapshot, or "Snapshot", is an instrument created by the Success for All Foundation (SFAF) to monitor schools' implementation progress. The research team used 2014-15 snapshot data to analyze various aspects of implementation in that year of the study.
sfama_snaps16_ruf. sas7bdat	The School Achievement Snapshot, or "Snapshot", is an instrument created by the Success for All Foundation (SFAF) to monitor schools' implementation progress. The research team used 2015-16 snapshot data to analyze various aspects of implementation in that year of the study.
sfama_tsvy15_ruf.sas7bdat	The teacher survey was distributed to teachers in spring 2015. The instrument was designed by the MDRC research team with the intention of comparing and contrasting the experiences of teachers at SFA PowerTeaching and control schools.
sfama_tsvy16_ruf.sas7bdat	The teacher survey was distributed to teachers in spring 2016. The instrument was designed by the MDRC research team with the intention of comparing and contrasting the experiences of teachers at SFA PowerTeaching and control schools.
sfama_psvy15_ruf.sas7bdat	The principal survey was distributed to principals in spring 2015. The instrument was designed by the MDRC research team with the intention of comparing and contrasting the experiences of principals at SFA PowerTeaching and control schools.
sfama_psvy16_ruf.sas7bdat	The principal survey was distributed to principals in spring 2016. The instrument was designed by the MDRC research team with the intention of comparing and contrasting the experiences of principals at SFA PowerTeaching and control schools.

sfama_tchlogs15_ruf.sas7bdat	The teacher log was distributed to teachers in spring 2015. The teacher log is an instrument designed by the MDRC research team, and the data were used to compare and contrast the particular aspects of reading instruction in SFA and control classrooms.
sfama_tchlogs16_ruf.sas7bdat	The teacher log was distributed to teachers in spring 2016. The teacher log is an instrument designed by the MDRC research team, and the data were used to compare and contrast the particular aspects of reading instruction in SFA and control classrooms.
sfa_SCH_ruf.sas7bdat	SFAF provided the MDRC research team a list of all scale-up schools. Like study schools, scale-up schools had to serve a large fraction (more than 50 percent) of minority students or students who were eligible for free or reduced-price lunch in Grades 6 through 8. MDRC research team used 2012-2013 CCD data to provide school level demographic information on all study and scale-up schools.

Data Codebooks

Each data file has an associated set of codebooks which define variables, formats, and summarize simple variable statistics. Codebooks are provided by year, and pertain to the main analytical sample[2]. For example, the dataset pertaining to the primary student sample has two associated codebooks: one for the 2014-2015 and one for the 2015-2016 academic year.

Primary Student Sample Data

The data file, 'SFAMA_IMP_RUF.SAS7BDAT' contains student-level test score and demographic data for the primary analysis sample: any student for whom valid test score data was provided for the 2014-2015 and/or 2015-2016 academic year. School districts provided these data. Districts removed student IDs and provided pseudo identifiers to allow MDRC to identify students across academic years and accurately process these data. The data in this file contain three main elements:

1. Baseline math test scores from State Standardized Tests in the spring of 2013 or 2014;
2. Yearly math test scores collected of two of the three implementation years (2014-2015 and 2015-2016);

[2] In the sections that follow, the main analytical samples are defined by data source.

3. Student demographic information collected from district student records.

Key Variables

State standardized test scores were provided for baseline and follow-up (outcome) school years. All test scores were standardized as follow:

1. Baseline standardized test scores = (baseline test score – district grade level mean) / district grade level standard deviation

2. Outcome standardized test scores = (outcome test score – control district grade level mean) / control district grade level standard deviation

<u>Treatment Flags</u>

The intent-to-treat treatment status was used in all analyses, signified by the "TREAT" variable name. The student's treatment status is determined by the last school they enrolled in during the outcome year (2014-2015 or 2015-2016).

<u>Demographic Variables</u>

For all years, demographic data for a given student was taken from the latest file for which they had available data. If an earlier file provided demographic data that was not provided in the latest file, then that data was appended into the latest file. Demographic variables include: SPED, ELL, FRLUNCH (free/reduced lunch), BLACK, WHITE, ASIAN, HISPANIC, OTHER (other race), MALE, and AGE. All dummy variables have indicators: 1 if the observation is applicable to a particular variable, 0 if the observation does not apply, and a blank observation if the data value is missing.

<u>Sample Flags</u>

<u>The main analytical samples</u> are highlighted by three sample flags:

- Confirm_7 – Includes any 7th grade student who had a valid spring test score in spring of 2015 (Cohort 1) or spring of 2016 (Cohort 1 and Cohort 2).

- Explore_6 – Includes any 6th grade student who had a valid spring test score in spring of 2016 or spring 2016

- Explore_8 – Includes any 8th grade student (Cohort 1) who had a valid spring test score in spring of 2016

<u>School and Student Identifiers</u>

Districts are identified by the variable DIST

Students are identified by the variable STUDENTID

Schools are identified by the variables XSCHID. The school variable used in analysis is the last school a student enrolled in that academic year.

Note: This data file is structured to include outcome data for two years (2014-2015 & 2015-2016). Variables names with a "_BL" suffix indicate baseline variable values for the two outcome years. Variable names without a "_BL" suffix indicate outcome data. The variable "FLAG_TESTYR" specifies the outcome year whereas, 1 equals 2014-2015 outcome data and 2 equals 2015-2016 outcome data.

For the 24 Cohort 1 schools, SY 2012-2013 is the baseline year and SY 2013-2014, SY 2014-2015, and SY 2015-16 are the first, second, and third implementation years, respectively. For the 34 schools in Cohort 2, on the other hand, SY 2013-2014 is the baseline year, and SY 2014-2015 and SY2015-16 are the first and second implementation years, respectively. The outcome measure — state math test scores — is not available for Cohort 1 schools for SY 2013-2014 due to a transition of state tests during that year.

School Achievement Snapshot Data

Introduction

The datasets containing snapshot data for the 2014-15 and 2015-16 years of the study are called sfama_snaps15_ruf.sas7bdat and sfama_snaps16_ruf.sas7bdat, respectively. .The school achievement snapshot (the "snapshot", for short) is a form created and used by the Success for All Foundation (SFAF) to monitor a school's progress in implementing various programmatic features. An original copy of the instrument has been included in this package. The MDRC research team primarily used the snapshot data to determine the extent to which schools in the study were implementing SFA with overall fidelity. The sfama_snaps15_ruf and sfama_snaps16 _ruf datasets contain one row per schoo and contain the SFA schools. The sfama_snaps16_ruf dataset contains the non-evaluation scale-up schools as well.. Variables pertaining to a given year are suffixed with the two-digit year corresponding to the spring of the academic school year. In addition to composite scores of various kinds, each individual scored item on the snapshot is provided. More details about this are provided below.

Variables

Variable names labeled with "SNSS1" pertain to School-wide Structures items; those labeled with "SNIP" pertain to Instructional Processes items; and those labeled with "SNSE" pertain to Student Engagement items. For more information about these headings, see the original snapshot instrument enclosed.

The two-digit year suffix corresponds to the year as of the spring term. Thus, a variable ending in "15" pertains to the 2014-15 academic school year.

<u>ID Variables and Sample Flags</u>

To protect the anonymity of schools, fake ID variables have been provided in place of actual school codes or names in the variable xSCHID. Districts have also been assigned a fake ID variable called DIST. Schools that implemented the PT program have been flagged by the variable "TREAT". The non-evaluation scale-up schools have been flagged by the variable SCALEUP.

Scoring Methodology

All variables reporting scores (or the percentage of the maximum possible score achieved) use a weighting scheme, devised by the MDRC research team and Success for All staff. Some items were double-weighted because they were considered more central to the SFA PowerTeaching program

SNSS items were binary, whereas SNIP and SNSE items were not; these items took on a value of 0, .4, .8 or 1. These numbers signify the estimated percentage of classrooms in which the reading practice asked about in the item is being implemented (estimated by the SFA staff-member who fills out the snapshot).

Because SNSE items were not directly related to implementation, but are more accurately characterized as short-term outcomes, these items were analyzed separately and not used in calculating the total score representing overall implementation fidelity.

Constructs

Items in the snapshot were organized according to the constructs presented in the "Structural and Supportive Components" and the "Implementation of the Three Key Elements" sections of the logic model in order to determine the extent to which various constructs in the logic model were implemented. What follows is a list of the items belonging to each construct.

I. Structural and Supportive Components

1. Program Developer

- SNSS1_WSCR
- SNSS2_WSCR

2. School Inputs

- SNSS4_WSCR
- SNSS7_WSCR

3. Continuous Development Processes

- SNSS8_WSCR
- SNSS22_WSCR
- SNSS34_WSCR
- SNSS35_WSCR

II. Implementation of the Three Key Elements

1. **Instructional Practices**
- SNIP1_WSCR
- SNIP3_WSCR
- SNIP5_WSCR
- SNIP6_WSCR
- SNIP7_WSCR
- SNIP10_WSCR

Teacher Survey Data

Introduction

'SFAMA_TSVY15_RUF.SAS7BDAT' and 'SFAMA_TSVY16_RUF.SAS7BDAT' are teacher-level datasets, containing survey responses to a teacher survey, created by the research team at MDRC, and fielded in the spring of 2015 and 2016. The survey data yielded information about teachers' background, teamwork in classrooms and teacher experiences and perceptions, especially as these related to math instruction and the school environment. The number of surveys fielded was determined by math teacher rosters, which school staff provided to the MDRC research team.

Sample

The 2015 and 2016 Teacher Survey was fielded at SFA Math study schools to teachers of "Math 6," "Math 7," "Math 8," and "Algebra 1" classes (and equivalent courses with different names) during the 2014-2015 school year. Teachers who only taught Geometry and/or pre-algebra were not included in the fielded sample.

All teachers in both 2014-2015 and 2015-2016 school year roster files, provided by school staff, were invited to participate in the survey. The 2014-2015 survey was fielded electronically and follow-up paper surveys were sent to schools after one month of electronic fielding (variable TSQ_MODE_15 indicates survey response mode). The 2015-2016 survey was only fielded electronically. During both survey years, if a teacher informed MDRC that she/he did not teach the math courses that met MDRC criteria for survey participation, these teachers were removed from the MDRC contact list. In total, 510 (2014-2015 academic year) and 484 (2015-2016 academic year) teachers from 58 schools respectively met MDRC survey criteria and were invited to participate in the SFA Math Teacher Survey(s).

<u>Analysis Sample</u>

AN_SAMPLE indicates any teacher who responded to the survey. This includes teachers who may have may have chosen not to take the survey by declining survey consent.

Key Variables

DIST indicates the district to which the teacher belonged in a given year.

XSCHID indicates the school a teacher belonged to in a given year. These IDs are consistent across data files in value. This means that school 5, for example, represents the same school, no matter what data file it comes from.

TREAT indicates the treatment status of the school the teacher belongs to in a given year.

TEACHERID identifies individual teachers and is consistent across teacher survey and teacher log datasets.

<u>General note on Teacher Survey Variable Names</u>

Item names take the general form: TSQ [item number]_[2 digit year suffix]. For example, TSQ10_15 holds a teacher's response, in 2014-15, to what is being called item 10. The item number corresponds to the number of the item on the teacher survey.

For the exact wording of items, refer to the actual instrument because the variable labels in the data are sometimes abbreviated.

Data Processing

The Spring 2016 survey has not been processed by MDRC. These data's variables are named and labeled in a manner that is consistent with other the 2015 teacher survey dataset. Duplicated survey entries, skip-logic errors, and other erroneous entries have not been checked for by the MDRC research team. The 2016 survey data is considered to be in its raw format.

Principal Survey Data

Introduction
The principal survey datasets, 'SFAMA_PSVY15_RUF.SAS7BDAT' and 'SFAMA_PSVY16_RUF.SAS7BDAT' contain principal responses to the surveys administered in spring of 2015 and spring of 2016. The surveys were created by the researchers at MDRC. The original surveys contain several text field responses that are not included in these data to protect principal and school anonymity. The original survey instruments are included. The survey data yielded information about principal background information, professional

development, general experience with school staff and math program at school, and experience with math state standards.

Sample

All principals who responded to the survey are included in the relevant year's analysis sample. In total, 58 principals from 58 schools were invited to participate in the SFA Math 2015 & 2016 Principal Survey

Key Variables (Identifiers)

DIST indicates the district to which the principal belonged in a given year.

XSCHID indicates the school a principal belonged to in a given year. These IDs are consistent across data files in value. This means that school 5, for example, represents the same school, no matter what data file it comes from.

TREAT indicates the treatment status of the school.

AN_SAMPLE indicates the schools that are considered to be part of the analytical sample.

<u>General note on item names</u>

Item names take the general form: PSQ [item number]_[2 digit year suffix]. For example, PSQ15_15 holds a principal's response, in 2014-15, to what is being called item 15. The item number corresponds to the number of the item on the principal survey.

Data Processing

The Spring 2016 survey has not been processed by MDRC. These data's variables are named and labeled in a manner that is consistent with the 2015 principal survey dataset. Duplicated survey entries, skip-logic errors, and other erroneous entries have not been checked for by the MDRC research team. The 2016 survey data is considered to be in its raw format.

SFA Scale-up and Study Schools Data

The dataset 'SFAMA_SCH_RUF.SAS7BDAT' contains information about schools that were part of the Investing in Innovations grant that funded the evaluation of SFAF's scale-up initiative. This includes 99 schools, which consist of 71 scale-up schools (30 randomly assigned to program/treatment evaluation sample) and 28 control schools used to compare results to the 30 schools in the treatment evaluation sample. To be recruited, scale-up schools had to serve a large fraction (more than 50 percent) of minority students or students who were eligible for free or reduced-price lunch in Grades 6 through 8.

The dataset contains data from the 2012-2013 academic school year obtained from the Common Core of Data (CCD) website http://nces.ed.gov/ccd/, which houses publically downloadable yearly datasets about schools and school districts.

Samples

EVAL_SAMPLE: indicates if a school is one of the 30 SFA schools being evaluated in this study.

AN_SAMPLE: an indicator that equals '1' if a school is either in the evaluation sample or is one of the 41 scale up schools

School and District Identifiers

DIST indicates school district

XSCHID indicates schools

IDs (DIST & XSCHID) are consistent across data files.

The majority of variables were calculated using raw CCD data. Calculated variables are noted with the word "Calculated" in the variable label.

Teacher Logs Data

Introduction

In order to understand the similarities and differences in math instruction that program group and control group students received, math teachers in both groups of schools were asked to complete instructional logs. Over a two-week period, they were to fill out a log for one student each day for up to eight randomly selected middle school students in grades six through eight.[3] A central question that the logs help answer is whether students in SFA classrooms and control classrooms are working together in groups, and whether these groups facilitate cooperative learning. The original log instruments are included.

The datasets, TCHLOGS15_RUF.SASBDAT and TCHLOGS16_RUF.SASBDAT, contain teacher log data for the 2014-15 school year and the 2015-16 school year respectively. Within each year, a teacher has up to eight records, corresponding to a log filled out by the teacher for a given student, on a particular day. The logs were created by the researchers at MDRC; the 2014-15 logs were filled out on paper and the 2015-16 logs were filled out electronically. The logs are slightly different across the two years, the main difference being the placement or elimination of questions resolved by electronic skip logic programming. We did not conduct analysis on the 2015-16 logs.

[3]The logs employed for this study were loosely adapted from those used by Brian Rowan, Eric Camburn, and Richard Correnti for the Study of Instructional Improvement conducted by the University of Michigan in partnership with the Consortium for Policy Research in Education.

The number of logs fielded at each school was determined by the math teacher rosters, which school staff provided to the MDRC research team each year. The teacher identification variable is called RESEARCHID.

Sample

Analysis Sample

The data only include logs kept for analysis. However, each year, a log was removed from the sample if it exhibited any of the following characteristics:

- If an entire log was returned blank.
- If it was unclear which student the teacher logged for.
- If the log was filled out by a non-consenting teacher.
- The teacher was not in the study.

Due to differences in the log instruments, a separate set of rules was applied to each file in order to clean up the data for analysis. These rules reflect the characteristics above and include circumstances unique to each file.

In 2014-2015, a log was removed from the sample in the following situations:

- Neither the student ID nor the alternate student ID was specified.
- The target student spent at least 15 minutes in the classroom (Question 1) but a response was specified for why the target student didn't spend at least 15 minutes in the classroom (Question 1A) and no alternate student is specified.
- The target student did not spend at least 15 minutes in the classroom (Question 1), a reason was not specified (Question 1A) and no alternate student is specified.
- The target student did not spend at least 15 minutes in the classroom, a reason was given for why the target student didn't spend at least 15 minutes in the classroom, but no alternate student was specified.

In 2015-2016, a log was removed from the sample in the following unique situations:

- The teacher responded to only one question in the entire log instrument
- Multiple logs were filled out for the same target student and no alternate student was specified.
- Multiple logs were filled out for the same alternate student.

Key Variables

Teachers are identified by the variable "TEACHERIDID". Teachers can be tracked across years using this variable.

The variable "XSCHID" indicates the school to which a teacher belonged in a given year. These IDs are consistent across data files in value. This means that school 5, for example, represents the same school, no matter what data file it comes from.

The variable "TREAT" indicates the treatment status of the school to which a teacher belonged in a given year.

The variable "STUDENTGRADE_15" indicates the grade of the student that the teacher logged for. This variable is only present in the 2014-15 logs file. Student grades were not provided on the 2015-16 file due to the change in survey administration.

The variable "ANALYSIS_FLAG_15" indicates which logs were used in the analysis conducted on the 2014-15 logs. This variable is not provided in the 2015-16 file.

Variables with a format similar to "TLQA1A_15" indicate the item on the log answered by the teacher. The labeling to the left of the underscore indicates the item on the log being answered (e.g. Teacher Log Question A1, item A); and the labeling to the right of the underscore indicates the version of the log on which this item can be found (e.g. _15 = 2015). Consult corresponding variable labels for a description of each item's contents.

Description of Logs

For each year of log implementation, teachers were asked to complete a log for one student each day for eight days. MDRC provided teachers with a list of randomly selected students for whom teachers could log for: a list of eight target students and a list of five alternate students. Each day, teachers were asked to log for a target student on the list provided. If a target student was absent or did not spend a certain amount of time in math instruction that day, the teacher was asked to complete the log for an alternate student instead.

<u>2014-15 Paper Logs</u>

In the 2014-15 logs, each teacher was mailed eight paper logs, each with a target student ID printed on it. Teachers were asked to fill out a log for their target student if the target student spent at least 15 minutes in the math period (Question 1). If the target student did not spend at least 15 minutes in the math period, the teacher was prompted to provide a reason in Question 1a and complete the log for an alternate student instead. In this case, teachers wrote in the ID of the alternate student at the top of the log.

Teachers were asked to provide the rank of the student's math ability (Question 2) for the student the teacher was logging for that day. Teachers were asked whether or not the student worked in a small group, pair, or worked individually during instruction that day (Question 3A, 3B, 3C). If the student worked in a small group or pair during math that day (teacher answered "Yes" to Questions 3A or 3B), the teacher would be eligible to answer Section A. If the student worked individually during math that day (teacher answered "Yes" to Questions 3C), the teacher would be eligible to answer Section B.

Section A

Section A asks teachers about the types of activities and time the student spent in a small group or pair. *If a student spent time in more than one small group or pair, the teacher would complete section A for the small group or pair that the student participated in the longest.*

Questions A1a through Alh were constructed to understand the types of math activities the student was engaging in, often related to the activities defined by the Common Core or state math standards. Responses to these questions were broken out into "buckets" of time ranges measured by the percent of instructional time spent in small groups or pairs.

Question A2 asks about whether the student presented a math solution on behalf of his/her group or pair. This question tries to get at the "team" aspect of working collaboratively – whether students were accountable for each other's learning by having to present their team's math solution individually to the class.

Question A3 asks how many math exercises the student worked on in their small group or pair.

Questions A4a through A4i were constructed to understand the behaviors the student exhibited while working in a small group or pair. Some of these behaviors may inhibit group learning while others facilitate collaborative education. These questions are structured similarly to Questions A1a through A1h. Responses to these questions were broken out into the same "buckets" of time ranges measured by the percent of instructional time spent in small groups or pairs.

Questions A5, A5a, and A5b ask specifically about the structure of the small group the student worked in. These questions regard the time the student spent working in their small group, how many other students were in the small group, and how the group was formed.

Question A6 asks how long the student spent in the pair he/she worked in, if the student spent the longest time in a pair rather than a small group.

Questions A7 and A8 ask about the total time the student spent in all small groups and all pairs he/she engaged in during math that day.

Section B

Section B asks teachers about the types of activities and time the student spent working individually.

Questions B1a through B1k were constructed to understand the types of math activities the student was engaging in individually, often related to the activities defined by the Common Core or state math standards.

Question B2 asks about whether the student presented a math solution he/she worked on individually to the class.

Question B3 asks how many math exercises the student worked on individually.

Question B4 asks about the total time the student spent working individually during math that day.

<u>2015-16 Electronic Logs</u>

In the 2015-16 logs, teachers were provided electronic links to access their logs. Teachers selected the target student they logged for from a pre-populated drop-down menu. The teacher was then prompted to answer Question 1, the number of minutes the student spent on math activities the teacher planned or supervised. If the teacher answered Question 1 with a response of fewer than 10 minutes, the teacher was rerouted back to the beginning to choose an alternate student from the drop-down menu.

Question 2 asks the teacher to provide a rank of the student's math ability. Questions 3A, 3B, and 3C ask how many minutes the student worked in a small group, pair, or individually during the math period that day. If the teacher answered Questions 3A and 3B with a response of more than five minutes, the teacher was eligible to answer Section A. If the teacher answered Question 3C with a response of more than five minutes, the teacher was eligible to answer Section B.

Section A

Section A asks teachers about the types of activities and time the student spent in either a pair or small group. If the student spent more time during the math period in a small group, the teacher would complete section A for the student's engagement in small groups. If the student spent more time during the math period doing pair work, the teacher would complete section A for the student's engagement in pairs. If the student spent the same amount of time in small groups and in pairs, the teacher would complete section A for the student's engagement in small groups. In summary, the teacher completes Section A for the collaborative structure the student was engaged in for the longest time during the math block. This designation is held in the PIPEDTEXTXXX variable in the dataset.

Question A1 asks whether the student worked in more than one small group or pair (whichever was their specified collaborative structure based on the PIPEDTEXTXXX variable).

If the teacher responded "Yes" to Question A1a, the teacher would answer Question A1a. Question A1a asks how many minutes the student spent in the specified collaborative structure they were in the longest.

Questions A1b and A1c are asked ONLY if the student's specified collaborative structure (in PIPEDTEXTXXX) is a small group. If the student worked in more than one small group, the teacher completes Questions A1b and A1c for the small group the student was in the longest. Question A1b asks how many other students were in the student's small group and Question A1c asks how the small group was formed.

Questions A2a through A2h were constructed to understand the types of math activities the student was engaging in, often related to the activities defined by the Common Core or state math standards. Responses to these questions were broken out into "buckets" of time ranges measured by the percent of instructional time spent in small groups or pairs. These are exactly the same as Questions A1a-A1h in the 2014-15 logs. Question A3 asks about whether the student presented a math solution on behalf of his/her group or pair (whichever is the specified collaborative structure). This question tries to get at the "team" aspect of working collaboratively – whether students were accountable for each other's learning by having to present their team's math solution individually to the class.

Question A4 asks how many math exercises the student worked on in their specified collaborative structure.

Questions A5a through A5i were constructed to understand the behaviors the student exhibited while working in the student's specified collaborative structure. Some of these behaviors may inhibit group learning while others facilitate collaborative education. These questions are exactly the same as Questions A4a-A4i in the 2014-15 logs.

Section B

Section B asks teachers about the types of activities and time the student spent working individually.

Questions B1a through B1k were constructed to understand the types of math activities the student was engaging in individually, often related to the activities defined by the Common Core or state math standards. These are exactly the same as Questions B1a through B1k in the 2014-15 logs.

Question B2 asks about whether the student presented a math solution he/she worked on individually to the class.

Question B3 asks how many math exercises the student worked on individually.

Analysis

This section describes the analysis conducted using the 2014-15 log file. MDRC did not conduct analysis on the 2015-16 logs.

The measures of interest pertain primarily to the responses regarding collaborative work – activities, behaviors and time the student spent in small groups or pairs (Questions A1a- A1h and A4a-A4i).

To construct the continuous measures used for analysis, the ranges for percent of instructional time spent on activities in Questions A1a-A1h and A4a-A4i were converted to minutes. The continuous measures were constructed as follows:

1) The categorical responses indicating a percentage time range for Questions A1a- A1h and A4a-A4i were converted to continuous percentages using the midpoint of the range:
    a. If the categorical response was "None" it was converted to zero percent
    b. If the categorical response was "Little" it was converted to 5 percent
    c. If the categorical response was "Some" it was converted to 17.5 percent
    d. If the categorical response was "Moderate" it was converted to 38 percent
    e. If the categorical response was "Considerable" it was converted to 75.5 percent
2) The total minutes spent in any small group (Question A7) and the total minutes spent in any pair (Question A8) were zero filled when missing values were present.
3) Analysis variables indicating the amount of time spent in **small groups** for each activity in Questions A1a- A1h and A4a-A4i were created using the logic below:
    a. If the student spent more than zero minutes in the small group the teacher was logging for in section A (Question A5), then multiply the percent of instructional time the student spent in each of the activities in Questions A1a- A1h and A4a-A4i (continuous, converted using the calculation in #1) by the total amount of time the student spent in any small group (Question A7, zero filled from #2)
        i. If the original ranges in Questions A1a- A1h and A4a-A4i were missing, the minutes spent in small groups for each activities Questions A1a- A1h and A4a-A4i equate to zero
4) Analysis variables indicating the amount of time spent in **pairs** for each activity in Questions A1a- A1h and A4a-A4i were created using the logic below:
    a. If the student spent more than zero minutes in the pair the teacher was logging for in section A (Question A6), then multiply the percent of instructional time the student spent in each of the activities in Questions A1a- A1h and A4a-A4i (continuous, converted using the calculation in #1) by the total amount of time the student spent in any pair (Question A8, zero filled from #2)
        i. If the original ranges in Questions A1a- A1h and A4a-A4i were missing, the minutes spent in pairs for each activities Questions A1a- A1h and A4a-A4i equate to zero

An impact analysis was used to compare the minutes spent on activities in groups and pairs by the average SFA school against the minutes spent on activities in groups and pairs in the average control school. These impact estimates were created for the overall sample and by student rank in math ability (Question 2). All estimations are based on a three-level hierarchical model with individual logs nested within teachers and teachers nested within schools. The model also controls for random assignment block fixed effects.

Appendix C

Success for All Foundation School Achievement Snapshot

PowerTeaching i3

SfAF

Snapshot Report

School: ______________________

District: ______________________

State: ______________________

Principal: ______________________

Math Coach: ______________________

Grades Implementing: ☐ 6 ☐ 7 ☐ 8 ☐ Other

Percent Proficient	Year 10	11	12	13	14
Math					
Attendance					

Grading Period	Start Date	End Date
Baseline		
1		
2		
3		
4		

Math Achievement: Percent on Grade Level										
G = Goal R = Results	Baseline		1		2		3		4	
	G	R	G	R	G	R	G	R	G	R
Grade 6										
Grade 7										
Grade 8										
ESL										
SPED										
Schoolwide Average										

Schoolwide Structures					
B	1	2	3	4	IP = In Place; N = Not in Place
Fundamentals					
					❶ All leaders and staff have received essential training. (1)
					❶ Materials necessary for program implementation are complete. (2)
					❶ School-based Math Coach is a full-time position. (4)
					❶ The principal is fully involved with PowerTeaching implementation. (7)
					❶ Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support. (8)
Assessment					
					❶ Accurate School Summary Form is maintained for every grading period. (19)
					❶ Formal math-benchmark assessments with consistent measures are conducted at the beginning of the year and at the end of each grading period. (20)
					❶ Teacher cycle record forms or weekly record forms are used by all teachers to record classroom data throughout the grading period. (21)
					❷ A Classroom Assessment Summary is submitted quarterly by each teacher. (22)
Leadership Team					
					❸ The Leadership Team meets monthly to review schoolwide data, and prepare for the quarterly meetings. (31)
					❸ The Leadership Team knows the number and percentage of students achieving at grade level and meeting quarterly proficiency goals. (32)
					❷ Quarterly meetings are held at the start of school and quarterly to review schoolwide progress toward achievement goals. (33)
					❷ Instructional component teams set SMARTS targets based on program data, chart progress, and work collaboratively to meet their targets. (34)
					❸ The school-based math coach uses the GREATER coaching process to support continuous improvement of student achievement through high-quality implementation. (35)

Priorities for implementation: ❶ mechanical ❷ routine ❸ refined

✔	B	1	2	3	4	(IP) Instructional Process*
						❶ Teachers use the basic lesson structure and objectives. Teachers use available media regularly and effectively. (1)
						❸ Active instruction is appropriately paced and includes modeling and guided practice that is responsive to students' understanding of the objective. (2)
						❷ Teachers use Think-Pair-Share, whole-group response, Random Reporter (or similar tools that require every student to prepare to respond) frequently and effectively during teacher presentation. (3)
						❸ Teachers restate and elaborate student responses to promote vocabulary mastery at a high standard of oral expression. (4)
						❷ Teachers provide time for partner and team talk to allow mastery of learning objectives by all students. (5)
						❸ Teachers facilitate partner and team discussion by circulating, questioning, redirecting, and challenging students to increase the depth of discussion and ensure individual progress. (6)
						❷ Following Team Talk or other team study discussion, teachers conduct a class discussion in which students are randomly selected to report for their teams; rubrics are used to evaluate responses, and team points are awarded. (7)
						❸ During class discussion, teachers effectively summarize, address misconceptions or inaccuracies, and extend thinking through thoughtful questioning. (8)
						❸ During class discussion, teachers ask students to share both successful and unsuccessful use of math strategies and graphic organizers. (9)
						❷ Teachers calculate team scores that include academic achievement points in every instructional cycle and celebrate team success in every cycle. (10)
						❸ Teachers use team scores to help students set goals for improvement, and students receive points for meeting goals. (11)

✔	B	1	2	3	4	(SE) Student Engagement*
						❶ Students are familiar with routines. (1)
						❸ Students speak in full, elaborate sentences when responding to teacher questions. (2)
						❷ Student talk equals or exceeds teacher talk. (Each student should be engaged in partner/team discussion as a speaker or active listener during half of class time.) (3)
						❷ Students are engaged during team/partner practice and labs. If needed, strategies such as talking chips or role cards are in use. (4)
						❸ Students use rubrics to meet expectations (e.g., Random Reporter). (6)
						❸ Teams are engaged in highly challenging discussions, in which students explain and offer evidence from their work to support their answers. (7)
						❷ Students value team scores and work daily to ensure that team members are prepared to successfully report for the team during Random Reporter and to succeed on tests. (8)

Fill in:

✓ = Area of focus
P = Power schoolwide – Objective is verified for 95% of teachers.
M = Mastery – Objective is verified for 80% of teachers.
S = Significant use – Objective is verified for 40% of teachers.
L = Learning – Staff members are working toward verification of this objective.

* Verified by observation or artifacts such as Team Score Sheets, facilitator observation records, videos, audio records, transcripts of instruction, or teacher records of student responses. Leave blank if documentation is not yet available.

Appendix D

Schoolwide Snapshot Items Used for Analysis

PowerTeaching i3

SfAF

Snapshot Report

School: ____________________

District: ____________________

State: ____________________

Principal: ____________________

Math Coach: ____________________

Grades Implementing: ☐ 6 ☐ 7 ☐ 8 ☐ Other

Percent Proficient	Year 10	11	12	13	14
Math					
Attendance					

Grading Period	Start Date	End Date
Baseline		
1		
2		
3		
4		

Math Achievement: Percent on Grade Level

G = Goal R = Results	Baseline G	Baseline R	1 G	1 R	2 G	2 R	3 G	3 R	4 G	4 R
Grade 6										
Grade 7										
Grade 8										
ESL										
SPED										
Schoolwide Average										

Schoolwide Structures

IP = In Place; N = Not in Place

B	1	2	3	4	
Fundamentals					
					1 All leaders and staff have received essential training. (1)
					1 Materials necessary for program implementation are complete. (2)
					1 School-based Math Coach is a full-time position. (4)
					1 The principal is fully involved with PowerTeaching implementation. (7)
					1 Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support. (8)
Assessment					
					1 Accurate School Summary Form is maintained for every grading period. (19)
					1 Formal math-benchmark assessments with consistent measures are conducted at the beginning of the year and at the end of each grading period. (20)
					1 Teacher cycle record forms or weekly record forms are used by all teachers to record classroom data throughout the grading period. (21)
					2 A Classroom Assessment Summary is submitted quarterly by each teacher. (22)
Leadership Team					
					3 The Leadership Team meets monthly to review schoolwide data, and prepare for the quarterly meetings. (31)
					3 The Leadership Team knows the number and percentage of students achieving at grade level and meeting quarterly proficiency goals. (32)
					2 Quarterly meetings are held at the start of school and quarterly to review schoolwide progress toward achievement goals. (33)
					2 Instructional component teams set SMARTS targets based on program data, chart progress, and work collaboratively to meet their targets. (34)
					3 The school-based math coach uses the GREATER coaching process to support continuous improvement of student achievement through high-quality implementation. (35)

Priorities for implementation: 1 mechanical 2 routine 3 refined

30 PowerTeaching School Leadership Reference Guide

✔	B	1	2	3	4	(IP) Instructional Process*
						Teachers use the basic lesson structure and objectives. Teachers use available media regularly and effectively. (1)
						Active instruction is appropriately paced and includes modeling and guided practice that is responsive to students' understanding of the objective. (2)
						Teachers use Think-Pair-Share, whole-group response, Random Reporter (or similar tools that require every student to prepare to respond) frequently and effectively during teacher presentation. (3)
						Teachers restate and elaborate student responses to promote vocabulary mastery at a high standard of oral expression. (4)
						Teachers provide time for partner and team talk to allow mastery of learning objectives by all students. (5)
						Teachers facilitate partner and team discussion by circulating, questioning, redirecting, and challenging students to increase the depth of discussion and ensure individual progress. (6)
						Following Team Talk or other team study discussion, teachers conduct a class discussion in which students are randomly selected to report for their teams; rubrics are used to evaluate responses, and team points are awarded. (7)
						During class discussion, teachers effectively summarize, address misconceptions or inaccuracies, and extend thinking through thoughtful questioning. (8)
						During class discussion, teachers ask students to share both successful and unsuccessful use of math strategies and graphic organizers. (9)
						Teachers calculate team scores that include academic achievement points in every instructional cycle and celebrate team success in every cycle. (10)
						Teachers use team scores to help students set goals for improvement, and students receive points for meeting goals. (11)

✔	B	1	2	3	4	(SE) Student Engagement*
						Students are familiar with routines. (1)
						Students speak in full, elaborate sentences when responding to teacher questions. (2)
						Student talk equals or exceeds teacher talk. (Each student should be engaged in partner/team discussion as a speaker or active listener during half of class time.) (3)
						Students are engaged during team/partner practice and labs. If needed, strategies such as talking chips or role cards are in use. (4)
						Students use rubrics to meet expectations (e.g., Random Reporter). (6)
						Teams are engaged in highly challenging discussions, in which students explain and offer evidence from their work to support their answers. (7)
						Students value team scores and work daily to ensure that team members are prepared to successfully report for the team during Random Reporter and to succeed on tests. (8)

Fill in:

✓ = Area of focus
P = Power schoolwide – Objective is verified for 95% of teachers.
M = Mastery – Objective is verified for 80% of teachers.
S = Significant use – Objective is verified for 40% of teachers.
L = Learning – Staff members are working toward verification of this objective.

* Verified by observation or artifacts such as Team Score Sheets, facilitator observation records, videos, audio records, transcripts of instruction, or teacher records of student responses. Leave blank if documentation is not yet available.

Appendix E
School Principal Survey

Scaling Up Success for All's Middle School Math Program

Spring 2016 Principal Survey

Conducted for the U.S. Department of Education

Welcome to the Scaling Up Success for All's Middle School Math Program Principal Survey.

Your school is participating in a major project designed to improve strategies for math instruction. This survey is part of that ambitious project and aims to understand the expectations of principals like you.

Your participation is important! For this study to be successful, we would like your thorough and honest responses so we can have as complete an understanding of different math programs.

There are a few things you should know before answering any questions...

1

Frequently Asked Questions

Q **What is this survey for?**

A MDRC, a not-for-profit, nonpartisan research organization with offices in New York City and Oakland, California is conducting a national study funded by the U.S. Department of Education. Among other things, the study seeks to understand the roles principals play in implementing math instruction in their schools. The purpose of this survey, which is being administered to principals in fifty-eight schools this year, is to learn how principals lead their schools and support math in particular.

Q **What are we asking you to do?**

A We are asking for your help. We would like you to answer as completely and candidly as possible all of the questions that apply to your school. This survey will take about 20 minutes to complete. Because only fifty-eight schools have been selected to be a part of this study in the first year of the study, it is important that we hear from all of the principals in these schools. We want to learn about your opinions and experiences. The information you provide will be critical for understanding the nature and impact of efforts to improve math instruction. While we hope that you will answer all of the questions, you may skip any you are not comfortable answering.

Q **What is our policy on privacy? Who will see your responses?**

A Your responses are confidential. We will not disclose your identity or information that identifies you to anyone who is not on the research team. Once sealed into the reply envelope provided with your survey, no one at your school or district will see your completed questionnaire. Results of the survey will be reported only in summary statistical form so that neither individuals nor their schools can be identified.

If you have any questions about this survey or about the study in general, please feel free to contact:

Shelley Rappaport MDRC
16 East 34th St
New York, NY 10016
(800) 221-3165, ext. 8893
shelley.rappaport@mdrc.org

General Instructions

This survey contains four sections:

1. *Your background and current responsibilities;*
2. *Your professional development;*
3. *The math program at your school: teacher support and evaluation;*
4. *The math program at your school: use of data;*
5. *The Common Core State Standards in Mathematics /The Mathematics Florida Standards;*
6. *Your school staff; and*
7. *The PowerTeaching Program*

In all items, "you" refers to you as principal of the school and not to any other instructional leader.

New Screen
YOUR BACKGROUND AND CURRENT RESPONSIBILITIES

We are trying to understand the environment in which the math program at your school operates. Please tell us about your professional background.

1. How many years during your career (including the 2015-16 school year) have you spent doing the following activities?
   Please indicate your best estimate of the number of school years you have spent in each activity.

Please round to the nearest whole number; if you spent half a school year or more in the activity, please round up, and if you spent less than half a school year, please round down.

a. Years spent as a principal at your current middle school. School year(s)
b. Years spent as a principal at other middle school(s). School year(s)
c. Years spent teaching at a middle school School year(s)
d. Years spent teaching math at a middle school School year(s)
e. Years spent working in any certified position at an elementary and/or high school School year(s)

New Screen

2. Recognizing that all responsibilities are important and necessary, which two of the following items have taken priority above the others during the 2015-16 school year? Your responsibility to...

Check only TWO:

a. Encourage teamwork among staff members.
b. Set high learning standards for all students.
c. Make expectations for meeting student learning goals clear to teachers.
d. Provide support for classroom discipline and order.
e. Engage parents in school activities and student learning.
f. Monitor your school's progress toward district and state standards.
g. Manage your school's finances.
h. Manage and respond to district policies and requirements.
i. Manage and respond to issues related to the community outside the school.
j. Assure instruction is of high quality and follows the adopted curriculum.
k. Other (specify)
l. Other (specify)

New Screen

3. Which two of the following items related to improving math instruction has taken priority above the others during the 2015-16 school year? Your responsibility to...

Check only TWO:

a. Serve as a knowledgeable source concerning math standards and curriculum.
b. Ensure that teachers have time for planning math instruction.
c. Provide teachers with adequate classroom materials to improve student math proficiency.
d. Ensure that teachers receive adequate professional development in math.
e. Reach out to parents to support math practices at home.
f. Ensure that teachers receive regular feedback regarding their math instruction from you, a math specialist or other instructional coach.
g. Other (please describe):
h. Other (please describe):

New Screen

YOUR PROFESSIONAL DEVELOPMENT

4. During the summer of 2015 or the 2015-2016 school year, did you participate in professional development in mathematics or mathematics instruction?
   a. Yes
   b. No //If not, please skip to Q10//

New Screen

5. We would like to learn about the different kinds of professional [development/learning] activities that were available to you and that you participated in during the 2015-16 school year, including summer 2015.

   <Yes, participated; Available, but did not participate; Not available>

   a. Math content (e.g., Algebra, geometry, probability, etc.)
   b. How students think about and learn mathematics (including common student difficulties)
   c. How to use your school's mathematics curricula/textbooks
   d. How to help teachers plan and structure lessons
   e. How to help teachers ask students questions and provide feedback
   f. How to help teachers interpret and use assessment data to guide instruction
   g. How to help teachers organize and manage the classroom
   h. How to help teachers teach students with diverse needs
   i. How to help teachers use technology in mathematics instruction
   j. Determining what features of teacher performance need to be improved and how.

6. Please reflect on your own professional development experiences this year. To what extent do you agree with the following statements? Overall, your own professional development experiences have:

   <Strongly disagree, Disagree, Agree, Strongly Agree>

   a. Been sustained and coherently focused~~.~~
   b. Included enough time to try, and evaluate new ideas.
   c. Included opportunities to work productively with teachers at your school.
   d. Included opportunities to work productively with other principals.
   e. Deepened your understanding of school leadership.

   a. How would you rate the professional development you have received in preparing you to support your math teachers?Poor
   b. Fair
   c. Good
   d. Excellent

New Screen
MATH PROGRAM AT YOUR SCHOOL: TEACHER SUPPORT & EVALUATION

The following items ask about general math activities at your school.

7. Since the start of the 2015-16 school year, about how frequently have you:
   <Never, Once or twice a year, Three or four times a year, Once or twice a month, At least once a week
   a. Conducted walk-throughs or observed math instruction.
   b. Provided informal feedback to teachers who you think need improvement in math instruction.
   c. Formally evaluated teachers in your school on their math instruction.
   d. Co-taught a math class, taught a demonstration math class or modeled a math class.
   e. Participated in a grade-level or subject meeting with all the relevant math teachers
   f. Met in small groups with teachers to discuss math.

New Screen

8. Since the start of the 2015-2016 school year, about how often have you looked for the following when you observed any individual teacher's instruction in math?
   <Not at all, Some of the time, Most of the time, All of the time, Not applicable>
   a. Math classes following a prescribed or recommended sequence of activities.
   b. Students working in pairs.
   c. Students working in groups (3 or more students).
   d. Teachers asking questions that require students to think deeply about math.
   e. Teachers communicating clearly to students the expectations for their assignment.
   f. Teachers engaging students in specific math techniques when students are working on a challenging math problem.
   g. Teachers using educational media or technology.
   h. Teachers' classroom management skills.
   i. Students are intellectually engaged.
   j. Teachers using routines to keep activities running smoothly.

9. Do math teachers at your school have access to a mentoring system?
   Please mark one choice.
   a. Yes, but only math teachers who are new to teaching (i.e. in their first job as teachers) have access.
   b. Yes, all math teachers who are new *to this school* have access.
   c. Yes, math all teachers at this school have access.
   d. No, at present there is no access to a mentoring system for math teachers in this school.

New Screen

13. Do you have an in-school or district coach, whose responsibilities include giving regular support (at least 2 periods a day or its equivalent) to math teachers ?at your school
    a. Yes
    b. No
    c. Don't know

14. How would you rate the quality of professional development your teachers have received in mathematics?
    a. Poor
    b. Fair
    c. Good
    d. Excellent
    e. Don't Know/No Opinion

15. To what extent do you agree with these statements as applied to this school?
    <Strongly Disagree, Disagree, Agree, Strongly Agree>
    a. The school staff share a common set of beliefs about schooling/learning.
    b. School staff have an open discussion about difficulties.
    c. There is a high level of cooperation between school and local community.
    d. There is mutual respect for colleagues' ideas.
    e. There is a culture of sharing success.
    f. The relationships between teachers and students are good.

New Screen

17. To what extent do you agree with the following statements? Since the start of the 2015-16 school year, your school has used data to…

< Strongly disagree, Disagree, Agree, Strongly agree>

a. Evaluate the math progress of students over time.
b. Examine school-wide instructional issues related to math.
c. Identify math teachers who need instructional improvement

New Screen

18. SS20 What type of assessments did/will students take during the 2015-2016 school year in math? [check all that apply??]
    a. Student universal screening or benchmark assessments
    b. Student curriculum embedded math tests (end of unit tests, weekly tests)
    c. Progress monitoring to determine whether sufficient math progress is being made in a timely manner
    d. State standardized math achievement test used for accountability purposes
    e. Other standardized math tests to determine student's math level
    f. None of the above

19. To what extent are you satisfied with the way that the math assessments have been used during the 2015-16 school year to measure your students' math skills?
    a. Very dissatisfied
    b. Dissatisfied
    c. Satisfied
    d. Very satisfied
    e. Don't Know/No Opinion

New Screen

THE [COMMON CORE STATE STANDARDS IN MATHEMATICS]

20. To what extent were you prepared during the 2015-16 school year to do the following?
    <Not at all, To a little extent, To some extent, To great extent, Not sure / Not applicable>
    a. Convey what the [Common Core State Standards in Mathematics/Mathematics Florida Standards] are about to your teachers and school staff.
    b. Influence teachers' motivation to implement the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    c. Clearly communicate to teachers the types of changes required by implementation of the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    d. Prioritize [Common Core State Standards in Mathematics/Mathematics Florida Standards] implementation, given other pressing needs.
    e. Support individual change
    f. Plan effective professional development to facilitate [Common Core State Standards in Mathematics/Mathematics Florida Standards] implementation.
    g. Provide effective instructional models for teachers to help support implementation of the [Common Core State Standards in Mathematics/Mathematics Florida Standards] in the classroom.
    h. Access practical how-to guidance to support the changes necessary to implement the [Common Core State Standards in Mathematics/Mathematics Florida Standards] .
    i. Make high-quality professional development available to teachers.
    j. Budget for effective [Common Core State Standards in Mathematics/Mathematics Florida Standards] implementation.
    k. Align the school's curriculum and instructional focus with the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    l. Evaluate teachers on implementation of the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    m. Incorporate the [Common Core State Standards in Mathematics/Mathematics Florida Standards] with new teacher evaluations or other state or national initiatives.
    n. Assure that standards-aligned programs are in place to positively affect students who struggle academically.
    o. Integrate the [Common Core State Standards in Mathematics/Mathematics Florida Standards] with programs that serve English language learners (ELLs), special education students, or students in other subgroups.
    p. Use expanded learning opportunities (e.g., extended day, after school) to support the [Common Core State Standards in Mathematics/Mathematics Florida Standards].

New Screen

21. Which of the following steps did you take to implement the [Common Core State Standards/Mathematics Florida Standards] in your school? (Mark all that apply)

    a. Adjusted our school improvement priorities to accommodate standards-related activities.
    b. Created a leadership plan, objectives, and a timeline for implementation of the mathematics [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    c. Sent school math staff to professional development sessions on the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    d. Modified our mathematics curriculum to align with the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    e. Gathered evidence through lesson plans, walkthroughs, and classroom observations to assess the effects of the Common Core on teaching.
    f. Identified or purchased new textbooks and curricular materials that were aligned with the [Common Core State Standards in Mathematics/Mathematics Florida Standards].
    g. Connected the [Common Core State Standards in Mathematics/Mathematics Florida Standards] with expanded learning opportunities (e.g., extended day, afterschool, or summer programs) in your school.
    h. Used expanded learning opportunities (e.g., extended school day, after-school, or summer programs) to support [Common Core State Standards in Mathematics/Mathematics Florida Standards] implementation.

New Screen
YOUR SCHOOL STAFF

22. The following questions ask about what kinds of changes in staffing that have taken place at your school during the 2015-2016 school year:

    a. How many math teachers joined your school?
    b. How many math teachers left your school?

23. Please indicate the type and extent of the staff changes in your school's math program in the 2015-2016 school year:

<Not at all, Yes, for some positions, Yes, for most positions >

    a. Your school increased staff.
    b. Your school reassigned math staff to new roles in other departments.
    c. Your school reassigned math staff to teach math courses they previously never taught
    d. Your school reduced staff.

New Screen

THE POWERTEACHING PROGRAM

//Only treatment schools see the next section//

The following questions concern the process related to implementation of POWERTEACHING at your school.

24. Had you personally had experience with PowerTeaching prior to the 2015-16 school year (in any capacity)?
    a. Yes
    b. No //If not, please skip to Q26//

25. Was it at this school?
    a. Yes
    b. No

New Screen

26. SS1 Did you receive initial training in it prior to or around the time that your school was meant to implement the PowerTeaching program?
    - Yes //skip to Q27//
    - No //skip to Q27N//

27. [Y] From whom did you primarily receive this training?
    - Success for All/ PowerTeaching staff
    - A math coach from my school
    - A colleague with experience in the PowerTeaching program
    - Self-taught
    - Other

27. [N] Why was this initial training not provided to you?
    - The Success for All/ PowerTeaching staff did not provide this initial training at my school
    - My colleagues who were more knowledgeable than I about the PowerTeaching program did not have either the time, resources or the inclination to provide this training
    - The initial training was provided before I knew I would be the principal at this school
    - I was not able to attend the initial training at the time it was provided
    - I did not know that the initial training was being provided
    - I chose not attend the initial training
    - Not sure

New Screen

28. SS2 Which of the following PowerTeaching program materials have your teachers used this school year?
    a. Snapshot
    b. Curriculum
    c. Online resources/disks
    d. Teacher guides

29. Now we would like to ask you about your experience with PowerTeaching this during the 2015-16 school year.
    <Not At All, Somewhat, Extremely, Don't Know, Not Applicable>
    a. How knowledgeable about PowerTeaching do you think your PowerTeaching [school-based/district-based] coach is this year?
    b. How helpful did you find the training offered to teachers on PowerTeaching prior to the start of and/or early in the current school year?

32. SS7 Since the start of the 2015-16 school year, to what extent do you agree that the following activities occurred.
    a. Math Leaders Team meetings (as suggested by PowerTeaching program)
    b. Coaching/supporting math teachers in their implementation of the PowerTeaching program
    c. Communicating about the PowerTeaching program with a school or district- based PowerTeaching math coach
    d. Communicating about PowerTeaching with a coach from the Success For All Foundation (SFAF)
    e. Participating in math team meetings with teachers at your school

New Screen

30. The following questions concern the changes in instructional practice at your school as a result of the school's involvement with POWERTEACHING in the 2015-16 school year. Please indicate to what extent you agree that the following occurred at your school.
    <Strongly Disagree, Disagree, Agree, Strongly Agree, Don't Know>

    a. The POWERTEACHING school/district-based coach provided you with useful feedback.
    b. The POWERTEACHING school/district-based coach has provided teachers with useful feedback.

c. Teachers at your school say the POWERTEACHING program doesn't provide them enough autonomy in how they teach.
d. As a result of POWERTEACHING, you have changed your process for observing classroom instruction.
e. As a result of POWERTEACHING, your school has changed its process for reviewing student math data.
f. As a result of POWERTEACHING, students at your school use more cooperative learning strategies.
g. Overall, your school has benefited from the POWERTEACHING program.

New Screen

31. Did you interact with a PowerTeaching coach(es) from SFAF since the start of the 2015-16 school year?

    Please select one response.

    a. Yes
    b. No
    c. Don't Know

    Programmer: If respondent selects "No" or "Don't Know" s/he is finished with survey.

32. (if yes) How helpful did you find the feedback from the PowerTeaching coach(es) from SFAF since the start of the 2015-16 school year?

    Please select one response.

    a. Not At All
    b. Helpful Somewhat
    c. Helpful
    d. Helpful Extremely

Appendix F
Engaged Leadership Variable

Snapshot Guidelines: Objectives for Schoolwide Structures

Most research about implementation of PowerTeaching was done with schools that had certain key structural components. When any of these schoolwide structures are omitted, the school may be disappointed in the results because their implementation is not based on the research-proven model.

These guidelines define the in-place requirements for each objective and can be used to direct the next steps for coaching and improving implementation of the objectives. The artifacts are suggestions for evidence that can be used to verify an objective or to guide coaching and next steps; they are not required to meet the objectives.

FUNDAMENTALS

❶ **All leaders and staff have received essential training. (1)** FIRST PRIORITIES

- All staff with instruction responsibilities have attended appropriate professional-development workshops and participated in online opportunities for help establishing a PowerTeaching classroom.
- Training services were provided by qualified and experienced presenters/leaders/coaches.

❶ **Materials necessary for program implementation are complete. (2)**

- All teachers and tutors have complete classroom materials and media for the program they are assigned to teach.
- School leaders have current PowerTeaching Snapshot guide and other reference documents.
- The school-based PowerTeaching Coach and staff have current teacher guides and access to disks or online resources for downloading sample agendas and related resources.

❶ **School-based PowerTeaching Math Coach is a full-time position. (4)**

- The school-based PowerTeaching Math Coach is identified and known in the school community.
- The school-based PowerTeaching Math Coach's primary responsibilities are supporting and coaching teachers and tutors, and assessing and tracking student progress. *See Appendix 2 for the school-based PowerTeaching Math Coach's statement of work.*

❶ **The principal is fully involved with PowerTeaching implementation. (7)**

- The principal consistently supports and sets expectations for full implementation of PowerTeaching.
- The principal organizes the school's calendar and resources so the teachers implementing PowerTeaching have enough time and membership to fulfill their purpose.
- The principal schedules school support visits with their SFAF coach. *See Appendix 1 for PowerTeaching Support Visit Protocols.*
- The principal visits all classrooms on a rotating, regular schedule. The principal attends component team meetings whenever possible.
- The principal communicates regularly with the school-based PowerTeaching Math Coach and SFAF coach to recognize strengths, address issues, and plan for improvements.
- The principal maintains the PowerTeaching vision and expectations while also listening and problem solving with the staff and community.

❶ **Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support. (8)**

- Instructional component team meetings are held twice a month.
- Meeting agendas and notes for follow-up are maintained by the school-based PowerTeaching Math Coach or other team leader. Concerns, questions, and solutions are shared with the SFAF coach.
- Teachers set goals and bring evidence of progress to team meetings.
- Team meetings are valued as an ongoing professional-development and collaborative opportunity. Input is welcomed from all team members.

Appendix G
Schoolwide Supports Variable

Snapshot Guidelines: Objectives for Schoolwide Structures

Most research about implementation of PowerTeaching was done with schools that had certain key structural components. When any of these schoolwide structures are omitted, the school may be disappointed in the results because their implementation is not based on the research-proven model.

These guidelines define the in-place requirements for each objective and can be used to direct the next steps for coaching and improving implementation of the objectives. The artifacts are suggestions for evidence that can be used to verify an objective or to guide coaching and next steps; they are not required to meet the objectives.

FUNDAMENTALS

❶ **All leaders and staff have received essential training. (1)** FIRST PRIORITIES

- All staff with instruction responsibilities have attended appropriate professional-development workshops and participated in online opportunities for help establishing a PowerTeaching classroom.
- Training services were provided by qualified and experienced presenters/leaders/coaches.

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- The principal maintains the PowerTeaching vision and expectations while also listening and problem solving with the staff and community.

❶ **Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support. (8)**

- Instructional component team meetings are held twice a month.
- Meeting agendas and notes for follow-up are maintained by the school-based PowerTeaching Math Coach or other team leader. Concerns, questions, and solutions are shared with the SFAF coach.
- Teachers set goals and bring evidence of progress to team meetings.
- Team meetings are valued as an ongoing professional-development and collaborative opportunity. Input is welcomed from all team members.

ASSESSMENT

❶ **An accurate School Summary Form is maintained for every grading period. (19)**

- A School Summary Form is completed within two weeks of the end of the grading period and is made available to the SFAF coach.
- Every student's math performance is reviewed by the teacher, the school-based math coach, and other colleagues or school leaders when appropriate and possible.
- Mastery is determined for every student based on formal and informal measures.

❶ **Formal math benchmark assessments with consistent measures are conducted at the beginning of the year and at the end of each grading period. (20)**

- Standardized assessments with consistent measures are administered to groups of PowerTeaching students at the beginning of the year and at the end of each grading period.
- Procedures are in place to guarantee consistent administration and accurate scoring of the assessments.
- Assessment results are recorded and analyzed to determine progress and mastery.

❶ **Teacher cycle record forms are used by all teachers to record classroom data throughout the grading period. (21)**

- All teachers use Teacher Cycle Record Forms or weekly record forms to collect classroom data every week.
- Enough data is recorded for each student to result in meaningful averages at the end of the grading period.
- The school-based PowerTeaching Math Coach or other school leader regularly checks schoolwide usage of the Teacher Cycle Record Forms.

❷ **A Classroom Assessment Summary is submitted quarterly by each teacher. (22)**

- Every teacher submits a Classroom Assessment Summary at the end of each grading period with enough classroom data about each student for scores and averages to be meaningfully analyzed and evaluated.
- The school-based math coach or other school leader reviews the Classroom Assessment Summary reports for consistency, accuracy, and completeness.

LEADERSHIP TEAM

❸ **The Leadership Team meets monthly to review schoolwide data and prepare for the Leading for Success quarterly meetings. (31)**

- The Leadership Team has been identified and ideally consists of more than the principal and school-based PowerTeaching Math Coach.
- There are regularly scheduled meetings, at least monthly.
- The entire Leadership Team attends these monthly meetings.
- The meetings are data-driven and start with a review of the schoolwide quarterly targets and goals.
- Leverage points are considered along with their correlation to the schoolwide quarterly targets.

Artifacts:

- School calendar with meetings scheduled for the year
- Agendas from the Leadership Team meetings
- Minutes of the Leadership Team meetings
- Interviews

❸ **Members of the school Leadership Team know the number and percentage of students achieving at grade level and meeting quarterly proficiency goals. (32)**

- Members of the Leadership Team can state the current number and percentage of students at grade level.
- Members of the Leadership Team can state the current number and percentage of students meeting quarterly proficiency goals.

Artifacts:

- Interviews

❷ **Quarterly meetings are held at the start of school and at the end of each grading period to review schoolwide progress toward achievement goals. (33)**

- Meetings are scheduled for the beginning of the year and at the end of each grading period.
- The meetings should at least be attended by the Leadership Team. Ideally, these meetings are conducted with the whole staff, if possible.
- The meetings review the schoolwide data, including yearly goals and quarterly targets.
- There is an opportunity for brief feedback and discussion regarding the initiatives and current concerns.
- Celebration is a part of every quarterly meeting.

Artifacts:

- School calendar with quarterly meetings scheduled
- Agendas for the quarterly meetings

❷ **Instructional component teams set SMARTS targets based on program data, chart progress, and work collaboratively to meet their targets. (34)**

- Instructional component teams meet twice a month.
- Teams are clear on the student data related to their area of focus.
- Members of each team collaborate to identify the leverage points on which they would like to focus.
- Plans are implemented that include participation by all members of the instructional component teams.
- Plans are reviewed at least quarterly to determine the impact they are having related to the instructional area of focus.

Artifacts:

- Agendas for the instructional component team meetings
- Minutes from the instructional component team meetings
- Reporting and planning guides for the instructional component teams

❸ **The school-based math coach uses the GREATER coaching process to support continuous improvement of student achievement through high-quality implementation. (35)**

- There is a schoolwide plan for coaching.
- The school-based math coach uses the GREATER coaching model with teachers formally or informally.
- The coaching plan is specific as to which teachers are participating. *See Appendix 3 for a Coaching Plan Template.*
- Opportunities are available for both formal and informal coaching.
- Teachers participating in the coaching plan are aware of their learning and performance goals.
- Goals set are related to the school goals, instructional component team targets, and leverage points.
- Goal attainment and goal progress are reviewed on a regular basis by the school-based math coach and participating teachers.
- Celebration is part of the coaching process.

Artifacts:

- Coaching plans

Appendix H
Program Fidelity Variable

Snapshot Guidelines: Objectives for Schoolwide Structures

Most research about implementation of PowerTeaching was done with schools that had certain key structural components. When any of these schoolwide structures are omitted, the school may be disappointed in the results because their implementation is not based on the research-proven model.

These guidelines define the in-place requirements for each objective and can be used to direct the next steps for coaching and improving implementation of the objectives. The artifacts are suggestions for evidence that can be used to verify an objective or to guide coaching and next steps; they are not required to meet the objectives.

FUNDAMENTALS

➊ **All leaders and staff have received essential training. (1)** FIRST PRIORITIES

- All staff with instruction responsibilities have attended appropriate professional-development workshops and participated in online opportunities for help establishing a PowerTeaching classroom.
- Training services were provided by qualified and experienced presenters/leaders/coaches.

➊ **Materials necessary for program implementation are complete. (2)**

- All teachers and tutors have complete classroom materials and media for the program they are assigned to teach.
- School leaders have current PowerTeaching Snapshot guide and other reference documents.
- The school-based PowerTeaching Coach and staff have current teacher guides and access to disks or online resources for downloading sample agendas and related resources.

➊ **School-based PowerTeaching Math Coach is a full-time position. (4)**

- The school-based PowerTeaching Math Coach is identified and known in the school community.
- The school-based PowerTeaching Math Coach's primary responsibilities are supporting and coaching teachers and tutors, and assessing and tracking student progress. *See Appendix 2 for the school-based PowerTeaching Math Coach's statement of work.*

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- The principal schedules school support visits with their SFAF coach. *See Appendix 1 for PowerTeaching Support Visit Protocols.*
- The principal visits all classrooms on a rotating, regular schedule. The principal attends component team meetings whenever possible.
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➊ **Instructional component teams meet at least twice a month to address professional-development needs and connect teachers to online and print resources for program support. (8)**

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- Meeting agendas and notes for follow-up are maintained by the school-based PowerTeaching Math Coach or other team leader. Concerns, questions, and solutions are shared with the SFAF coach.
- Teachers set goals and bring evidence of progress to team meetings.
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ASSESSMENT

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- A School Summary Form is completed within two weeks of the end of the grading period and is made available to the SFAF coach.
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- Mastery is determined for every student based on formal and informal measures.

❶ **Formal math benchmark assessments with consistent measures are conducted at the beginning of the year and at the end of each grading period. (20)**

- Standardized assessments with consistent measures are administered to groups of PowerTeaching students at the beginning of the year and at the end of each grading period.
- Procedures are in place to guarantee consistent administration and accurate scoring of the assessments.
- Assessment results are recorded and analyzed to determine progress and mastery.

❶ **Teacher cycle record forms are used by all teachers to record classroom data throughout the grading period. (21)**

- All teachers use Teacher Cycle Record Forms or weekly record forms to collect classroom data every week.
- Enough data is recorded for each student to result in meaningful averages at the end of the grading period.
- The school-based PowerTeaching Math Coach or other school leader regularly checks schoolwide usage of the Teacher Cycle Record Forms.

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- Every teacher submits a Classroom Assessment Summary at the end of each grading period with enough classroom data about each student for scores and averages to be meaningfully analyzed and evaluated.
- The school-based math coach or other school leader reviews the Classroom Assessment Summary reports for consistency, accuracy, and completeness.

LEADERSHIP TEAM

❸ **The Leadership Team meets monthly to review schoolwide data and prepare for the Leading for Success quarterly meetings. (31)**

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- There are regularly scheduled meetings, at least monthly.
- The entire Leadership Team attends these monthly meetings.
- The meetings are data-driven and start with a review of the schoolwide quarterly targets and goals.
- Leverage points are considered along with their correlation to the schoolwide quarterly targets.

Artifacts:

- School calendar with meetings scheduled for the year
- Agendas from the Leadership Team meetings
- Minutes of the Leadership Team meetings
- Interviews

❸ **Members of the school Leadership Team know the number and percentage of students achieving at grade level and meeting quarterly proficiency goals. (32)**

- Members of the Leadership Team can state the current number and percentage of students at grade level.
- Members of the Leadership Team can state the current number and percentage of students meeting quarterly proficiency goals.

Artifacts:

- Interviews

❷ **Quarterly meetings are held at the start of school and at the end of each grading period to review schoolwide progress toward achievement goals. (33)**

- Meetings are scheduled for the beginning of the year and at the end of each grading period.
- The meetings should at least be attended by the Leadership Team. Ideally, these meetings are conducted with the whole staff, if possible.
- The meetings review the schoolwide data, including yearly goals and quarterly targets.
- There is an opportunity for brief feedback and discussion regarding the initiatives and current concerns.
- Celebration is a part of every quarterly meeting.

Artifacts:

- School calendar with quarterly meetings scheduled
- Agendas for the quarterly meetings
- [illegible]

❷ **Instructional component teams set SMARTS targets based on program data, chart progress, and work collaboratively to meet their targets. (34)**

- Instructional component teams meet twice a month.
- Teams are clear on the student data related to their area of focus.
- Members of each team collaborate to identify the leverage points on which they would like to focus.
- Plans are implemented that include participation by all members of the instructional component teams.
- Plans are reviewed at least quarterly to determine the impact they are having related to the instructional area of focus.

Artifacts:

- Agendas for the instructional component team meetings
- Minutes from the instructional component team meetings
- Reporting and planning guides for the instructional component teams

❸ **The school-based math coach uses the GREATER coaching process to support continuous improvement of student achievement through high-quality implementation. (35)**

- There is a schoolwide plan for coaching.
- The school-based math coach uses the GREATER coaching model with teachers formally or informally.
- The coaching plan is specific as to which teachers are participating. *See Appendix 3 for a Coaching Plan Template.*
- Opportunities are available for both formal and informal coaching.
- Teachers participating in the coaching plan are aware of their learning and performance goals.
- Goals set are related to the school goals, instructional component team targets, and leverage points.
- Goal attainment and goal progress are reviewed on a regular basis by the school-based math coach and participating teachers.
- Celebration is part of the coaching process.

Artifacts:

- Coaching plans

Snapshot Guidelines: Objectives for Instructional Process (IP)

Teachers use the basic lesson structure and objectives. Teachers use available media regularly and effectively. (IP-1)

Expectations: ❶

- Refer to the Program Introduction Checklist on the Online Hub.

Hints and Suggestions:

- Refer to artifacts and interviews with students and teachers to verify this objective. If observing, classroom visits should be long enough or often enough to verify this objective in both Active Instruction and Teamwork parts of the lesson.
- Refer to instructional component process charts in the appendix to check that all parts of the lesson and program are in place.
- The teacher may make short-term adaptations for transitions or for special-needs students.
- Observers are strongly encouraged to use copies of the lesson plan for the day of observation. It helps observers who are new to the program to better understand what they are seeing and hearing. Many observers find it convenient for note taking as well.

Artifacts/exemplars to demonstrate achievement of expectations:

- PowerTeaching Lesson Peer Review Form
- PowerTeaching Structures Peer Review Form
- Written/video reflections of the PowerTeaching lesson components (both daily and assessment day components)
- Student-written/video reflections of the PowerTeaching framework and reactions to Q &A media
- Screen capture of the Program Implementation Checklist

All artifacts/exemplars require a written explanation supporting each Snapshot objective in order to be submitted to the school-based portfolio.

Teachers use Think-Pair-Share, whole-group response, and Random Reporter (or similar tools that require every student to prepare to respond) frequently and effectively during teacher presentation. (IP-3)

Expectations: ❷

- Most student responses are elicited by correctly using an appropriate variety of Think-Pair-Share, whole-group response, or Random Reporter structures.
- Think-Pair-Share is implemented correctly as defined and trained by SFAF.
- Whole-group response is implemented correctly as defined and trained by SFAF.
- Random Reporter is implemented correctly as defined and trained by SFAF.
- The teacher has modeled and helped students practice how to respond with Think-Pair-Share, whole-group response, and Random Reporter.
- Teachers appropriately vary the use of discussion structures in the lesson, depending on the kind of question or prompt being used and the developmental readiness of students.

Hints and Suggestions:

- Schedule observations during Active Instruction.
- It may be helpful to tally every teacher question or invitation for response and every student response within each category (Think-Pair-Share, whole-group response, Random Reporter). Observers may also tally missed opportunities, such as the teacher interacting with only one student, the teacher calling on students with raised hands, or too much teacher talk with no invitations to students for response and interaction. The number of student responses in these combined categories should indicate that they are used to elicit most student responses.
- Interview students about the use of the discussion structures; ask questions that help to determine how frequently they are used and how comfortable students are with responding.

Artifacts/exemplars to demonstrate achievement of expectations:

- Monitoring the Use of the Assessment for Learning Techniques Peer Review Form
- Monitoring the Use of Random Reporter Peer Review Form
- Monitoring the Use of Think-Pair-Share Peer Review Form
- Monitoring the Level of Questioning Peer Review Form
- Student-written/video reflection of Random Reporter and Think-Pair-Share
- Video or picture of a minute-by-minute assessment or whole-group response techniques
- Screen capture of the minute-by-minute assessment or whole-group response technique checklist
- Screen capture of the Assessment Self-Assessment

All artifacts/exemplars require a written explanation supporting each Snapshot objective in order to be submitted to the school-based portfolio.

Teachers provide time for partner and team talk to allow mastery of learning objectives by all students. (IP-5)

Expectations: ❷

- Partner/team discussions are being provided for as designed in the lesson.
- Most students have enough time to meet expectations during partner/team discussion for student mastery of learning objectives.
- The teacher understands the importance of partner and team discussion as part of team study/practice within the Cycle of Effective Instruction.

Hints and Suggestions:

- Observation should be appropriate during any partner or team discussion or practice activity.
- This objective is interrelated to others in the Student Engagement section of the Snapshot.

Artifacts/exemplars to demonstrate achievement of expectations:

- Teacher-created PowerTeaching lesson plan/flipchart detailing Teamwork process
- Video showcasing team interactions
- Student-written/video reflection about Teamwork expectations
- PowerTeaching Lesson Peer Review Form
- PowerTeaching Structures Peer Review Form
- Monitoring Student Use of Team Cooperation Goals Form

All artifacts/exemplars require a written explanation supporting each Snapshot objective in order to be submitted to the school-based portfolio.

Teachers facilitate partner and team discussion by circulating, questioning, redirecting, and challenging students to increase the depth of discussion and ensure individual progress. (IP-6)

Expectations: ❸

- Teachers purposefully monitor and interact with students appropriately and continually during partner practice, team study and discussion, learning labs, etc.
- The teacher circulates and listens to students, monitoring the quality of team and partner interactions.
- The teacher prompts learning and mastery and helps students extend their discussions or lab activities to do so.
- The teacher asks purposeful questions to check progress, models how to respond to one another, helps to extend the discussion, or provokes self-evaluation. (Examples: *What are you doing? Why do you say/do that? Can you tell us how that works? How can you help your partner? What do you want to do differently next time?*)
- The teacher intervenes and redirects students who are struggling or not meeting expectations.
- Redirection includes a short review or reteaching, rephrasing directions or questions to help students understand, giving specific feedback about correctness of practice exercises, or guiding students to resolve a conflict.
- Teachers challenge students by suggesting an alternate approach, focusing students on another aspect of the text or discussion, giving specific feedback that prods students to do more than the minimum required, or encouraging students to extend their work and to build on their excitement over learning or new ideas.
- In early learning programs, the teacher interacts with students through dramatic play in learning labs.

Hints and Suggestions:

- Observation should be appropriate during any partner or team discussion or practice activity.
- Low-level teacher monitoring may only ensure that students are on task, which is not enough to meet this objective.
- Look for student use and teacher reference to role cards or other lesson materials that support effective partner and team discussion.

Artifacts/exemplars to demonstrate achievement of expectations:

- Written/video reflection of teacher's role during teamwork (include anecdotal notes)
- Monitoring the Use of the Assessment for Learning Techniques Peer Review Form
- Monitoring the Level of Questioning Peer Review Form
- Student-written/video reflection of teacher's role during Teamwork
- Student-written/video reflection of how individual accountability is built into the Teamwork process
- Screen capture of the Teamwork Self-Assessment

All artifacts/exemplars require a written explanation supporting each Snapshot objective in order to be submitted to the school-based portfolio.

Following Team Talk or other team study discussion, teachers conduct a class discussion in which students are randomly selected to report for their teams; rubrics are used to evaluate responses, and team points are awarded. (IP-7)

Expectations: ❷

- Class discussion always takes place as planned in the lesson.
- The teacher randomly selects students to report for their team during class discussion.
- Class discussion is conducted via team reports from randomly selected students.
- The teacher engages and motivates students to share their team's ideas and contributions.
- The teacher explicitly reinforces team accountability for each student's success.
- Scoring rubrics or other specific comments provide meaningful feedback.
- The teacher's feedback connects the quality of the representative student's response to the team's overall preparation for class discussion.
- The teacher awards team points for excellent responses (e.g. Team Celebration Points poster, pocket points, team cooperation points).
- Teams know how the points were earned.
- All teams have opportunities during the week for teammates to be randomly selected for reporting to the whole class.

Hints and Suggestions:

- Plan observations during class discussion or any whole-group review.
- Look for student and teacher reference to scoring rubrics in lesson materials or on flip charts.
- Some programs may refer to checklists, scoring guides, or criteria instead of rubrics; they should all be considered when looking for evidence that this objective is in place.
- Look for teacher use of sharing sticks, Random Reporter sticks, or flip-chart gimmicks for selecting students to represent their teams.

Artifacts/exemplars to demonstrate achievement of expectations:

- Video showcasing class debriefing
- TCRF showcasing Random Reporter scores
- Student-written/video reflection of class debriefing
- Monitoring the Use of Random Reporter Peer Review Form
- Video of teacher/students providing feedback using the Random Reporter rubric
- Video of students being awarded Team Celebration Points and the transfer of points from the Team Score Sheet to the Team Celebration Points Poster

All artifacts/exemplars require a written explanation supporting each Snapshot objective in order to be submitted to the school-based portfolio.

Teachers calculate team scores that include academic achievement points in every instructional cycle and celebrate team success in every cycle. (IP-10)

Expectations: ❷

- Records are available for every lesson cycle in the grading period, including Team Score Sheets, Teacher Cycle Record Forms, or Celebration Certificates
- Average team scores are computed and reported for every instructional cycle.
- Celebration is observed or documented for every instructional cycle.
- The previous cycle's average team scores are available on the Team Score Sheets.
- During class celebration, certificates are distributed, goals that were met are acknowledged, and cheers may be encouraged.
- The class, team, and individual Celebration Certificates list the team's status and average score.
- Team success is recognized and celebrated for every instructional cycle.

Hints and Suggestions:

- Plan observations for lesson days when Team Score Sheets and Celebration Certificates with scores from the previous cycle are distributed and reviewed.
- Celebration activities and certificates may be either observed or described by a student.
- Teacher cycle record forms with team scores do not have to be observed during instruction; these should be available for review with the teacher.
- Consider making a chart that lists every lesson cycle for the grading period to track teacher cycle records in every classroom.
- Consider meeting with teachers to review their Teacher Cycle Record Forms, especially if there are gaps during the grading period.
- Consider interviewing students to confirm that celebration, Team Score Sheets, team average scores, team recognition, and Celebration Certificates are consistent features of the lesson cycle.

Artifacts/exemplars to demonstrate achievement of expectations:

- Completed Team Score Sheets
- Student-written/video reflection explaining team scoring process
- Student-written/video explanation of Improvement Points
- Pictures of Celebration Certificates posted in the classroom.
- Picture or flipcharts showcasing team status records on the Team Celebration Points poster
- Video showcasing assessment day components
- TCRF/CAS showcasing team success over time
- Screen capture of the Celebration Self-Assessment

All artifacts/exemplars require a written explanation supporting each Snapshot objective in order to be submitted to the school-based portfolio.

Appendix I

Homewood Institutional Review Board Approval Letter

JOHNS HOPKINS UNIVERSITY

Homewood Institutional Review Board
3400 N. Charles Street
Wyman Park Building, Suite N468
Baltimore MD 21218-2685
410-516-6580
http://homewoodirb.jhu.edu/

Michael McCloskey, PhD
IRB Chair

Date: June 18, 2018

PI Name: Robert Slavin
Study #: HIRB00007574
Study Name: The study of school leadership impact on PowerTeaching Math program fidelity and student achievement.

Date of Review: 6/18/2018
Date of Approval: 6/18/2018
Expiration Date: 6/18/2021

The above referenced study has been *approved.*

Review Type:	Exempt
Funding Agency:	Not funded
Grant or Contract Number:	
International Sites:	No
Maximum number of participants:	There were 31,102 participants enrolled in the study.
Vulnerable populations:	Children
Consent process:	Waiver of informed consent
Assent Process:	Waiver or alteration of assent Waiver or alteration of parental permission

Please keep in mind that it is your responsibility to inform the HIRB of any adverse consequences to participants that occur in the course of the study, as well as any complaints from participants regarding the research. In conducting this research, you are required to follow the requirements listed in the *HIRB Policies and Procedures Manual*.

Study Team Members:
Paul Miller
Nancy Madden

APPROVAL IS GRANTED UNDER THE TERMS OF FWA00005834 FEDERAL-WIDE ASSURANCE OF COMPLIANCE WITH DHHS REGULATIONS FOR PROTECTION OF HUMAN RESEARCH SUBJECTS

Paul D. Miller

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EDUCATION

Johns Hopkins University Graduate School of Education Baltimore, MD	Doctor of Education (Ed.D.)	2018
University of Maryland Baltimore County (UMBC) Baltimore, MD	Masters of Arts (M.A.)	2003
University of Maryland College Park, MD	Bachelor of Arts (B.A.)	2000

PROFESSIONAL EXPERIENCE

Association of Climate Change Officers, Hollywood, FL	• Director of Credentialing & Training Programs	2018 - present
Johns Hopkins University School of Education, Baltimore, MD	• Adjunct Facility, Course Developer, Teaching Assistant	2017 - present
Johns Hopkins University School of Education Center for Technology in Education, Baltimore, MD	• National Outreach & Project Evaluation Manager (2017-2018) • Director, Personalized Learning (2015-2016)	2015-2018
Success for All Foundation, Inc. Baltimore, MD	• Investing in Innovation (i3) STAD Math Project Director (2011-2017) • Investing in Innovation (i3) Around the Corner Project Manager (2011-2013) • Developer of Professional Learning Resources/Curriculum Project Developer (2009-2011) • Math Developer (2007-2009)	2007-2017

Edison Schools, Inc. Baltimore, MD	• Math Curriculum & School Testing Coordinator (2004-2007) • Math/Science Teacher (2004-2006)	2004-2007
UMBC Baltimore, MD	• Technology Instructor (2003-2004) • School to University Coordinator (2002-2004)	2002-2004
Baltimore City Public Schools (BCPS) Baltimore, MD	• Math Teacher	2002-2004

PRESENTATIONS/CONFERENCES (Selected)

Tailoring Learning Paths for Decision-Makers & Measuring Progress. Climate Week NYC (2018). New York, NY.

What to do with all of that math data? (co-presented with FEVTutor). NWEA Fusion (2018). Portland, OR.

Personalized Learning: A Collaborative-based Model for Student Success. Gooru Symposium (2016). Redwood City, CA.

Reflections of an i3 Evaluation and Scale-up (co-presented with Dr. Nancy A. Madden). i3 Annual Project Director's Meeting (2016). Washington D.C.

Cooperative Learning Gets Social. iNACOL (2015). Orlando, FL.

Cooperative Learning Meets Personalized Learning. National Forum to Accelerate Middle-Grades Reform - 11th Annual Conference (2015). Washington D.C.

Student-Teams Achievement Divisions: An Equation for Success. NCTM Annual Meeting & Exposition (2014) New Orleans, LA.

Cooperative Learning: The Ongoing Model for Success. AMLE Annual Conference (2013). Minneapolis, MN.

Promoting Learning with New Media (co-presented with Dr. Nancy A. Madden). i3 Annual Project Directors Meeting (2013). Washington D.C.

An Overview of Success for All. Teach First Conference (2008). London, England.

PowerTeaching and Data-Driven Instructional Practices in Mathematics. Pennsylvania Governor's Institute (2008). State College, PA.

CERTIFICATION(S)/AFFILIATIONS

Project Management Certification
Russell Martin & Associates Online

Advanced Professional Teaching Certificate
Maryland State Department of Education

Train-the-Trainer Certification, Level 2
Marriott International, Inc.

National Council of Teachers of Mathematics (NCTM)
Member